# TRANSCRIPT OF RECORD

(IN TWO VOLUMES)

## SUPREME COURT OF THE UNITED STATES

October Term, 1934

No. 221

THE UNITED STATES OF AMERICA, INTERSTATE COMMERCE COMMISSION, ET AL., APPELLANTS

vs.

THE BALTIMORE AND OHIO RAILROAD COMPANY, CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY, THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY COMPANY, ET AL.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF OHIO

VOLUME I

FILED JULY 30, 1934

# SUPREME COURT OF THE UNITED STATES

## OCTOBER TERM, 1934

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THE UNITED STATES OF AMERICA, INTERSTATE COMMERCE COMMISSION, ET AL., APPELLANTS

vs.

THE BALTIMORE AND OHIO RAILROAD COMPANY, CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY, THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY COMPANY, ET AL.

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| Edward Landers | 1103 | 927 |
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| A. C. Adams | 1110 | 931 |
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| T. H. Doyle | 1202 | 992 |
| Alex. Whittaker | 1203 | 993 |
| J. C. Mayo | 1204 | 994 |
| J. H. Keisling | 1206 | 995 |
| J. A. Boatwright | 1209 | 997 |
| L. B. Woodward | 1211 | 998 |
| B. C. Thompson | 1214 | 1000 |
| A. C. Blalock | 1216 | 1002 |
| J. A. McDermott | 1218 | 1003 |
| F. C. Wilson | 1220 | 1004 |
| J. M. Hopkinson | 1222 | 1005 |
| M. H. Bell | 1225 | 1008 |
| H. E. Dulmage | 1228 | 1009 |
| Roy Burns | 1229 | 1009 |
| W. M. Sigafoose | 1229 | 1010 |
| C. W. Groves | 1231 | 1011 |
| C. C. Ray | 1231 | 1011 |
| Edward Evenson | 1232 | 1012 |
| O. J. Thorsen | 1233 | 1013 |
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| Charles C. Stiff | 1235 | 1014 |
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| Charles B. Sexton | 1275 | 1044 |
| Arthur L. Burns | 1277 | 1045 |
| J. W. Chadwick | 1280 | 1047 |
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| J. A. Monahan | 1284 | 1050 |
| C. J. Maye | 1285 | 1051 |
| A. D. Fowlkes | 1287 | 1052 |
| R. F. Thomas | 1289 | 1054 |
| C. H. Pruder | 1290 | 1054 |
| L. W. Potter | 1292 | 1055 |
| H. P. Crowell | 1294 | 1057 |
| C. F. Sager | 1295 | 1058 |
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| F. B. Hand | 1305 | 1064 |
| Jesse L. Blesh | 1307 | 1066 |
| R. J. Sawyer | 1311 | 1068 |
| W. B. Varner | 1318 | 1073 |
| H. R. Miller | 1321 | 1074 |
| H. A. Gibson | 1322 | 1075 |
| C. J. Field | 1323 | 1076 |
| W. B. Wills | 1324 | 1077 |
| George Reith | 1329 | 1080 |
| W. J. Hayward | 1332 | 1081 |
| A. R. Yarborough | 1334 | 1083 |
| J. H. Dalzell | 1341 | 1087 |
| George E. Stearns | 1353 | 1095 |
| W. H. Bailey | 1362 | 1102 |
| George H. Warfel | 1369 | 1107 |
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| George E. King | 1422 | 1142 |
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A [Caption omitted.]

B [Caption omitted.]

1 In United States District Court for the Northern District of Ohio, Eastern Division

[File endorsement omitted.]

No. 4681

THE BALTIMORE AND OHIO RAILROAD COMPANY; CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY; The Chicago, Rock Island and Pacific Railway Company; Chicago and Eastern Illinois Railway Company; The Delaware and Hudson Railroad Corporation; Erie Railroad Company; Great Northern Railway Company; Missouri Pacific Railroad Company; The New York Central Railroad Company; The New York, New Haven and Hartford Railroad Company; Norfolk Southern Railroad Company and G. R. Loyall and L. H. Windholz, Receivers thereof; Northern Pacific Railway Company; The Pennsylvania Railroad Company; Port Huron and Detroit Railroad Company; Reading Company; Seaboard Air Line Railway Company and L. R. Powell, Jr., and Henry W. Anderson, Receivers thereof; Southern Pacific Company; Susquehanna and New York Railroad Company; Union Pacific Railroad Company, and Wabash Railway Company and Walter S. Franklin and Frank C. Nicodemus, Jr., Receivers thereof, Petitioners,

*vs.*

UNITED STATES OF AMERICA, Defendant

*Petition*

Filed May 31, 1933

The petitioners above-named, respectfully show unto the court:

I

Each of said petitioners, and each of the railroad companies hereinafter mentioned, now is and at all times herein mentioned
2 has been a corporation duly organized and existing as such under the laws of one or more of the States of the United States, or is a receiver of such corporation, regularly appointed and duly empowered to join as a petitioner in this suit, and each of them now is and at all times herein mentioned has been engaged in the

business of operating one or more lines of steam railway for the transportation of freight and passengers, as a common carrier for hire, between two or more States in the United States, and each of said petitioners and each of the railroad companies hereinafter mentioned (the petitioners and the said railroad companies being hereinafter collectively referred to as the "Railroads"), now are, and at all times herein mentioned have been subject to a certain act of Congress commonly referred to as the Boiler Inspection Act. (February 17, 1911, c. 103, 36 Stat. 913, as amended March 4, 1915, c. 169, 38 Stat. 1192, and June 7, 1924, c. 355, 43 Stat. 659; 45 U.S.C. 22 et seq.

The respective addresses of the petitioners and the names of the State, or States, under the laws of which petitioners are organized, are as follows:

The Baltimore and Ohio Railroad Company, Baltimore, Maryland. Incorporated under the laws of Maryland.

Chicago, Burlington & Quincy Railroad Company, 547 W. Jackson Blvd., Chicago, Ill. Incorporated under the laws of Illinois.

The Chicago, Rock Island and Pacific Railway Company, LaSalle Street Station, Chicago, Ill. Incorporated under the laws of Illinois and Iowa.

Chicago and Eastern Illinois Railway Company, 332 S. Michigan Avenue, Chicago, Ill. Incorporated under the laws of Illinois.

The Delaware and Hudson Railroad Corporation, The Delaware & Hudson Railroad Bldg., Albany, New York. Incorporated under the laws of New York.

3 Erie Railroad Company, Midland Building, Cleveland, Ohio. Incorporated under the laws of New York.

Great Northern Railway Company, St. Paul, Minnesota. Incorporated under the laws of Minnesota.

Missouri Pacific Railroad Company, Missouri Pacific Bldg., St. Louis, Mo. Incorporated under the laws of Missouri.

The New York Central Railroad Company, 466 Lexington Avenue, New York, N. Y. Incorporated under the laws of New York, Ohio, Illinois, Indiana, Pennsylvania and Michigan.

The New York, New Haven and Hartford Railroad Company, New Haven, Connecticut. Incorporated under the laws of Connecticut, Massachusetts and Rhode Island.

Norfolk Southern Railroad Company, Norfolk, Virginia, and G. R. Loyall and L. H. Windholz, Receivers, same address. Incorporated under the laws of Virginia.

Northern Pacific Railway Company, 5th and Jackson Streets, St. Paul, Minn. Incorporated under the laws of Wisconsin.

The Pennsylvania Railroad Company, Broad-Street Station Building, Philadelphia, Pa. Incorporated under the laws of Pennsylvania.

Port Huron and Detroit Railroad Company, Port Huron, Michigan. Incorporated under the laws of Michigan.

Reading Company, Reading Terminal, Philadelphia, Pa. Incorporated under the laws of Pennsylvania.

Seaboard Air Line Railway Company, Norfolk, Virginia, and L. R. Powell, Jr., and Henry W. Anderson, Receivers, same address. Incorporated under the laws of Virginia and other States.

Southern Pacific Company, 65 Market Street, San Francisco, Calif. Incorporated under the laws of Kentucky.

4 Susquehanna and New York Railroad Company, Williamsport, Pennsylvania. Incorporated under the laws of Pennsylvania.

Union Pacific Railroad Company, 1416 Dodge Street, Omaha, Nebraska. Incorporated under the laws of Utah.

Wabash Railway Company, Railway Exchange Bldg., St. Louis, Mo., and Walter S. Franklin and Frank C. Nicodemus, Jr., Receivers, same address. Incorporated under the laws of Indiana.

## II

This proceeding is brought for the purpose of having enjoined, set aside, annulled and suspended an order of the Interstate Commerce Commission entered January 5, 1933, as supplemented by certain subsequent orders, in Interstate Commerce Commission Docket No. 24050, known as the "Power Reverse Gear" case (reported in 190 Interstate Commerce Commission Reports, 351, hereinafter more specifically set forth and referred to), which order, effective July 1, 1933, provides in substance that the petitioners and numerous other railroad companies hereinafter referred to substitute power-operated reverse gears for manually operated reverse gears on all locomotives above a certain weight on driving wheels, approximately 18,000 in all, and also that emergency steam connections be placed on all locomotives now equipped with power-operated reverse gears, nearly 29,000 in all, at a total estimated cost of nearly $7,500,000.

This order of the Commission was issued upon complaint of A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, each of them being the

5 chief executive of their respective brotherhood organizations, the membership of which is recruited from the engine-service employees of the railroads. Each of said chief executives resides in the northern district of Ohio, eastern division, A. Johnston at 3197 Warrington Road, Shaker Heights, Cleveland, Ohio; and D. B. Robertson at 3115 Scarborough Road, Shaker Heights, Cleveland, Ohio.

The venue of this suit is fixed by 28 U.S.C. 43.

Jurisdiction of this court is invoked under the provisions of the Judicial Code, 28 U.S.C. 41 (8) & (28), 28 U.S.C. 45, 46, 47, and 48, and other applicable federal statutes.

The defendant, United States of America, is sued pursuant to express authority granted by the Congress of the United States by 28 U.S.C. 46, 47, and 48.

The Interstate Commerce Commission (hereinafter referred to as the "Commission"), is a tribunal created by the act to regulate commerce, approved February 4, 1887, as amended (49 U.S.C. 1 et seq.), and is specifically vested with certain powers and duties under the provisions of said act. The Commission is also granted specific powers and duties, of a strictly limited nature under the Boiler Inspection Act, which are entirely independent of and distinct from its powers and duties under the Interstate Commerce Act, as more particularly appears from the provisions of the Boiler Inspection Act itself.

III

The petitioners attach to this petition as exhibits, and pray that they be considered a part hereof, the following: Exhibit A, complaint of complainants before the Commission (except appen-
6 dix); exhibit B, answers and supplemental answers of defendants before the Commission, and exhibit C, report and order of the Commission. The record before the Commission is so voluminous as to make it impracticable to attach it as an exhibit to this bill, but a certified copy of the transcript of the testimony and exhibits (except exhibits nos. 26 and 27 omitted by stipulation) is lodged with the clerk, herewith, and reference is hereby made thereto.

IV

The questions involved in this suit are of common and general interest to and affect more than 690 railroad companies (the "Railroads", above referred to), who appeared as defendants in the proceeding hereinafter mentioned before the Interstate Commerce Commission, and, by and through two associations known, respectively, as the American Railway Association and The American Short Line Railroad Association opposed the complaint and petition of the above mentioned complainants. Approximately 440 of said railroads joined in the answer and in amended and supplemental answers filed in their behalf by the American Railway Association before the said Commission. Approximately 250 of said railroads joined in the answer filed in their behalf by the American Short Line Railroad Association before the said Commission. Lists of said railroads are shown as appendixes to the said original answers and copies thereof and included in exhibit B, hereto attached.

Each and every one of said railroads was and is subject to the said Boiler Inspection Act and affected by the said order of the Commission, and was a party defendant throughout the proceedings before the Commission herein mentioned. The lines of railway operated by the Railroads cover the entire continental United
7 States and constitute practically all of the important steam railway mileage therein. The said railroads are so numerous as to make it impracticable to bring them all before this court;

and they constitute a class which is fairly represented by the petitioners herein, whose lines extend into and through the greater part of the territory within the United States. This suit is filed by these petitioners, who sue on behalf of themselves and of all other railroads subject to the Interstate Commerce Act which may have an interest in the subject matter of this suit.

V

The reversing gear, or "reverse gear" as it is usually called, of a steam locomotive is the mechanism which controls the position and movement of the locomotive valve gear and valves which admit steam into the cylinders, and it is by means of this mechanism that the direction of movement of the locomotive is controlled, and the proper and economical use of steam is accomplished. Two general classes of reverse gears are in use, viz: (1) Manually operated reverse gears which depend upon the use of muscular force of the engineer and the force exerted by counterbalancing weights and springs, for their operation; and (2) power reverse gears which supplement the above-mentioned forces with an auxiliary mechanism which, in normal operation, brings the force of compressed air into play, so that less muscular effort is normally required to be put forth by the engineer in using this type of gear. The engineer operates either class of gear by means of either a lever or handwheel (used with screw type of gear) located near his seat-box in the locomotive cab. At the end of the year 1930 the railroads owned more than 60,500 locomotives, of which more than 28,900 were then equipped with
8 power reverse gears and more than 31,500 with manually operated reverse gears or hand reverse gears as they are often called.

VI

In their said complaint before the Commission, complainants there alleged (1) that the railroads are using "or permitting to be used on their respective lines locomotives not in proper condition and safe to operate in the service to which the same are put, and without being so equipped that the same may be employed in the active service of such carriers without unnecessary peril to life or limb, in violation of the provisions of section 2 of the Boiler Inspection Act of February 17, 1911, as amended, in the following particulars, to wit: That said locomotives are being so used without same being equipped with power reverse gear." Therein said complainants further alleged that the said locomotives "are equipped with manually operated reverse gear; that said manually operated reverse gear is improper, unsuitable, and unsafe, and the use thereof unnecessarily endangers the health, comfort, and general welfare of the engineers and firemen, and subjects the engineers and firemen and other employees of said defendants, the traveling public, and

travellers on the highways to unnecessary peril to life or limb in the following particulars, to wit: Said manually operated reverse gear is inherently improper, unsuitable, and unsafe in principle and design."

Further allegations of said complaint before the Commission amplify the above charge by stating that manually operated reverse gears (1) subject engineers to undue fatigue and physical strain; (2) frequently break or fail, thereby subjecting the gear to great force and strain, and frequently causing the reverse lever to
9 go out of control and to strike and severely injure the engineer; (3) that use of manually operated reverse gear frequently requires the engineer and fireman to place themselves in a hazardous position; (4) prevents them from performing the necessary duties of observing signals and keeping an effective lookout; and (5) generally subjects the employees of the defendants and the traveling public to unnecessary peril to life or limb.

Complainants there further alleged "that power reverse gear has been developed which is practical, suitable, and safe to use", and that the chief inspector under the Boiler Inspection Act in making recommendations for the good of the service has urged the adoption of a rule requiring locomotives to be equipped with power reverse gears; that the Director General of Railroads during Federal control specified such devices on new locomotives; and that a number of railroads have equipped and are now operating a large number of locomotives with such power reverse gear.

The prayer of the complaint was that (1) the defendants "be severally required to answer the charges herein"; (2) after due hearing an order be entered "commanding the defendants and each of them to cease and desist from the violation of the Boiler Inspection Act as amended hereinbefore alleged and set forth"; (3) that the Commission make and prescribe appropriate rules "for the equipment of all locomotive engines propelled by steam with power reverse gear, or other devices adequate to protect the employes upon said locomotives from unnecessary peril to life or limb, as provided in section 2 of said Boiler Inspection Act as amended", and (4) such other and further order or orders as the Commission may consider proper.

10 VII

By their answer, and their amended supplemental answers to the above mentioned complaint, the railroads stated:

1. "That this Commission following the enactment of said Boiler Inspection Act and the first amendment thereof, had before it certain rules and instructions for the inspection and testing of steam locomotives and tenders and parts and appurtenances thereof, said rules and instructions having been prepared by the chief inspector pursuant to section 5 of said act; and after due consideration the Commission approved same. Thereafter from time to time changes of said rules and instructions made at the request of the carriers have been ap-

proved by the Commission. That said rules and instructions as thus changed from time to time contain no provisions with respect to power reverse gears, and this Commission is without authority or jurisdiction to make any rules or instructions with respect to power reverse gears under the said Boiler Inspection Act as amended, the Commission's authority under said act at the present time being limited to approval or disapproval of changes in the rules and instructions which may be submitted to it for approval pursuant to section 5 of said act."

2. "That the said Boiler Inspection Act, as amended, provides that in case any district inspector shall in the performance of his duty find any locomotive or tender, or part thereof, not conforming to the requirements of the law, or the rules and regulations approved thereunder by the Commission, the said inspector shall have the right to give notice thereof to the carrier and require same to be withdrawn from service, the carriers then having the right to appeal from such notice and decision to the chief inspector and then to the Commission itself, pending which time the equipment must remain out of service; that the carriers are also subject to penalties of $100 for every violation of such act as provided in section 9 thereof; that these
11 remedies and means are the only means provided for the enforcement of the act and the rules and instructions thereunder, and that no right is given in said act to require the carriers as a whole to be brought in to answer charges as prayed for in the complaint herein, nor for the Commission to enter an order requiring carriers to cease and desist from violating the act as prayed for in said complaint."

3. "That under the said Boiler Inspection Act, as amended, the means provided for enforcement thereof has to do exclusively with each individual locomotive and its condition at any particular time when it is alleged not to be in proper condition and safe to operate as required by the act; and this Commission is without any authority in law to entertain this complaint, to proceed with a hearing in this matter, or to grant the relief requested in the complaint filed herein, or any part thereof."

4. "That a power reverse gear is not a safety device or appliance within the meaning of section 2 of the Boiler Inspection Act of February 17, 1911, as amended, and that the Interstate Commerce Commission is without jurisdiction to entertain the complaint in this proceeding."

5. That while power reverse gears are suitable and useful for certain classes of locomotives, that with respect to other classes they are neither suitable, useful, nor necessary; that it is the policy and practice of the railroads to equip new locomotives with power reverse gears, but only to equip such existing locomotives where such equipment is desirable, which they respectfully submit is a matter of management which may be safely left to the railroads themselves; that the power reverse gears heretofore produced are the result of several

years of experimentation; that further experimentation and changes are now being carried out in an endeavor to further perfect these devices; and that in numerous instances power reverse gears have been found so unsuitable and impracticable in actual use that it has become necessary to remove same, while in other instances such gears have proven so defective and expensive of operation as to be of doubtful suitability.

12 VIII

After extensive hearings the Commission, acting by and through its division 6, on January 5, 1933, entered the following order (included in exhibit C, hereto attached) in the said proceeding:

"This case being at issue upon complaint and answers on file, and having been duly heard and submitted by the parties, and full investigation of the matters and things involved having been had, and the division having, on the date hereof, made and filed a report containing its findings of fact and conclusions thereon, which said report is hereby referred to and made a part hereof:

"It is ordered, That rule no. 157 of the rules and instructions for the inspection and testing of steam locomotives and tenders approved and established in accordance with the act of February 17, 1911, as amended, be, and it is hereby, amended to read as follows:

"157. Reverse gear.—Reverse gear, reverse levers, and quadrants shall be maintained in a safe and suitable condition for service. Reverse lever latch shall be so arranged that it can be easily disengaged, and provided with a spring which will keep it firmly seated in quadrant. Proper counterbalance shall be provided for the valve gear.

"(a) All steam locomotives built on or after April 1, 1933, shall be equipped with a suitable type of power operated reverse gear.

"(b) All steam locomotives used in road service built prior to April 1, 1933, which weigh on driving wheels[1] 150,000 pounds or more, and all steam locomotives used in switching service built prior to April 1, 1933, which weigh on driving wheels 130,000 pounds or more, shall have such power-operated reverse gear applied
13 the first time they are given repairs defined by the United States Railroad Administration as class 3,[2] or heavier, and all such steam locomotives shall be so equipped before January 1, 1937.

"(c) Air-operated power reverse gear shall have a suitable steam connection with the operating valves conveniently located in the cab of the locomotive and so arranged and maintained that in case of air failure steam may be quickly used to operate the reverse gear."

On January 28, 1933, the Commission issued the following additional order therein:

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[1] Weight on driving wheels means the weight of a locomotive in working order that is supported by the coupled driving wheels when it rests on a straight and level track, as defined in the Locomotive Cyclopedia.

[2] Class 3 repairs as defined by the United States Railroad Administration are as follows: Flues all new or reset (superheater flues may be excepted); necessary repairs to firebox and boiler; tires turned or new; general repairs to machinery and tender.

"Upon further consideration of the record in the above-entitled proceeding:

"It is ordered, That the order of January 5, 1933, be, and it is hereby, modified to the extent of adding the following to paragraph (c) thereof:

"'This paragraph shall become effective July 1, 1933.'

"By the Commission, division 6.

"(Seal.)"

On March 18, 1933, the Commission issued its further order in said proceeding, reading as follows:

"Upon further consideration of the record in the above-entitled proceeding, and of the petition of certain railroads for additional time in which to prepare specifications and to secure materials necessary to the application of power reverse gear on locomotives built prior to April 1, 1933, as referred to in paragraph (b) of the order entered in this proceeding on January 5, 1933:

"It is ordered, That said order of January 5, 1933, as modified by order of January 28, 1933, be, and it is hereby, further modified to the extent of adding the following to paragraph (b) thereof:

"'This paragraph shall be effective on locomotives turned out of shops on and after July 1, 1933.'

14 "It is further ordered, That in all other respects said order of January 5, 1933, as modified by said order of January 28, 1933, shall remain in full force and effect.

"By the Commission, division 6.

"(Seal.)"

Prior to the issuance of said last-mentioned order, the railroads had on February 11, 1933, filed a petition praying for a reconsideration by and a reargument before the entire Commission, and on April 3, 1933, the Commission entered its further order in the said proceeding, reading as follows:

"Upon further consideration of the record in the above-entitled proceeding, and of the petitions and supplemental petition of defendant carriers for reconsideration and reargument:

"It is ordered, That said petitions, and supplemental petition, be, and they are hereby, denied.

"By the Commission.

"(Seal.)"

That said order of January 5, 1933, and the said report, set forth in said "exhibit C", as modified by the succeeding orders above mentioned, are herein referred to collectively as the "order" in the above-mentioned proceeding, unless the context definitely indicates a different meaning.

## IX

The order is without any warrant or authority in law, is contrary to law, and void because entirely beyond the statutory power of the Commission for the reasons set forth in the amended and supple-

mental answers of the railroads above quoted herein. These reasons were urged by the railroads and included in an appropriate motion made at the commencement of, and renewed during the prog-
15 ress of the hearings; were fully explained and urged before division 6 of the Commission; and have been consistently maintained by the railroads throughout the proceeding. The motion was denied and the Commission unlawfully assumed jurisdiction, pursuant to the said complaint of complainants, and unlawfully proceeded to the entry of the order aforesaid.

In this behalf petitioners allege and show that the Commission erred in holding it had authority to proceed in this matter pursuant to the complaint of complainants therein, and to hear and determine alleged violations of the Boiler Inspection Act in the manner prescribed for proceedings respecting rates and other matters under the Interstate Commerce Act; and in holding that it had authority to modify the existing code of rules under the Boiler Inspection Act pursuant to the complaint (as decided by it on the third and fourth pages of its report herein—190 I.C.C. 353–4); and the Commission erred in denying the motion of these petitioners and the other railroads made at the commencement of, and renewed during the course of the hearings, and in overruling their objections aforesaid, because the Commission was without any jurisdiction to entertain a complaint in this case or proceed in any manner under said complaint, or to enter any order in the premises, and its decision respecting the said matters above mentioned, and its order, are without warrant or authority in law and are contrary to the law in the following particulars:

(1) In the several respects set forth in the amended and supplemental answers above quoted herein.

(2) There is no authority conferred upon the Commission by the Boiler Inspection Law, or any other law, to entertain a complaint as in the "Power Reverse Gear" case, or to proceed thereunder in any manner.

(3) The only authority granted to the Commission under the Boiler Inspection Law as amended, in the matter of making
16 rules, is to approve, modify, or disapprove such rules as may be submitted to it under the provisions of the act.

(4) The said Boiler Inspection Law as amended grants to the Commission no authority to make or initiate the making of new rules.

(5) No power is granted to the Commission under the Boiler Inspection Act as amended, to modify existing rules or initiate modifications of same.

(6) There is no authority granted to the Commission under the said Boiler Inspection Act as amended, nor under any other law, to conduct a hearing, as was done in this case, for the purpose of investigating whether or not additional rules, or modifications of old rules under the act, should be considered or formulated nor is any authority granted to proceed with the consideration or formulation thereof at such hearing, or at any other time.

(7) Likewise no authority is given to the Commission to proceed in such manner to determine whether or not the Railroads are operating locomotives in violation of the Boiler Inspection Act.

(8) The Boiler Inspection Act is an independent piece of legislation and must be construed and enforced as such.

## X

Aside from the above mentioned lack of jurisdiction and statutory authority in the Commission, and on the theory and allegations of the complaint pursuant to which the order was entered, the order is illegal, arbitrary, unreasonable, beyond the power of the Commission, and hence void, because it is devoid of essential findings of fact in the following particulars:

1. The complaint alleges that all manually operated reverse gears are unsuitable and unsafe, and that a locomotive equipped with a gear cannot be operated in the service to which the same is put
17 without unnecessary peril to life or limb, and on the basis of this allegation prays that the order of the Commission shall require power reverse gears, or other devices, to be placed upon all of these locomotives which are now equipped with manually operated reverse gears in order that said locomotives may be placed in a safe and suitable condition for operation in compliance with the Boiler Inspection Act. An essential finding of fact to support an order pursuant to such a complaint would be that all locomotives equipped with manually operated reverse gears are, because of that fact, unsafe and unsuitable for operation in the service to which the same are put, and incapable of being operated without unnecessary peril to life or limb. The order of the Commission contains no such finding as to all locomotives equipped with manually operated reverse gears, and it contains no finding with respect to any one or more of such locomotives. That the Commission was of the opinion that the manually operated reverse gear is not an inherently unsuitable and unsafe device, and hence it could not make the finding above suggested, definitely appears from the Commission's order which permits continued operation of approximately one-half of all locomotives now equipped with manually operated reverse gears.

2. Had the Commission found the manually operated reverse gear to be inherently unsuitable and unsafe as alleged in the complaint, it would further have been necessary to the granting of the relief prayed for therein, for the Commission to find that the only way of remedying the situation complained of would be by replacing all manually operated reverse gears with power reverse gears on the locomotives in question, and that no "other devices" as prayed for in the complaint would suffice. The Commission made neither of these findings which would have been essential to sustain an order in this case in any event.

8. The Commission's order would require installation of power reverse gears to replace manually operated reverse gears on all locomotives above certain specified weights, yet the Commission
18 made none of the essential findings specified above herein with respect to the locomotives above the specified weights which would be affected by the order.

4. The order contains no findings to the effect that the use of all or any of the locomotives equipped with manually operated reverse gears cannot be continued by the railroads without unnecessary peril to life or limb.

5. The order contains no finding with respect to the use of locomotives equipped with manually operated screw reverse gears, as distinguished from manually operated handbar reverse gears, or whether locomotives equipped with such screw reverse gears can or cannot continue to be operated without unnecessary peril to life or limb.

6. The order contains no finding that past operation of any of said locomotives has caused unnecessary peril to life or limb.

7. The order contains no finding that the power reverse gear is a safety device, or that substitution of a power reverse gear for a manually operated reverse gear upon any or all of the locomotives affected by the order, would transform same from locomotives which are not in proper condition and safe to operate in the service to which the same are put and may not be employed in the active service of the railroads without unnecessary peril to life or limb, into locomotives which are safe and suitable for operation in the respective services in which same will be used, and that the same, and each of them, would then, by reason of such substitution of reverse gears, be such that they may be employed in the active service of the railroads without unnecessary peril to life or limb.

8. There is in said order no finding or findings of any essential facts which would be necessary to support the order upon Complainants' own theory of the law.

19 XI

Aside from the above-mentioned lack of jurisdiction and statutory authority in the Commission, and on the theory and allegations of the complaint pursuant to which the order was entered, the order is illegal, arbitrary, unreasonable, beyond the power of the Commission, and hence void, because it is contrary to the evidence and unsupported by any substantial evidence in the following particulars:

(1) That there was no evidence presented before the Commission which would have supported any of the essential findings above mentioned, but there was substantial and uncontradicted evidence to the contrary.

(2) That the evidence submitted to the Commission on behalf of both complainants and defendants agreed to the effect that the ques-

tion of suitability and safety of manually operated reverse gear has no relation whatsoever to the weights of locomotives on driving wheels. There is no substantial evidence in the case to the contrary.

(3) That the uncontradicted evidence before the Commission shows that there have been fewer accidents with the manually operated screw reverse gear than with any other type of gear, and there is no evidence of record which tends in any way to prove that this type of gear is unsuitable or unsafe, on the locomotives of the railroads so equipped, for operation in the service to which the same are put without unnecessary peril to life or limb. The record shows the railroads are operating more than 1,550 locomotives equipped with this type of gear; yet the Commission's report and order make no findings and no different'ation as between this and other types of manually operated reverse gear.

(4) That the report of division 6 shows on its fact that the Commission failed and refused to consider the uncontradicted evidence submitted by the railroads as to their precarious financial condition and their imperative necessity of conserving their cash and credit in order to meet current operating expenses and fixed charges. It further shows that the Commission disregarded said evidence in the making of its order, and in that behalf based its order on expected future improvement in financial conditions, not shown of record and not true in fact.

(5) That the order of the Commission ignores, fails to give consideration to, and is directly contrary to the following important facts established by the uncontradicted evidence before it:

(a) That installation and use of power reverse gears on locomotives have not eliminated accidents in the operation thereof, caused by or in connection with the use of reversing gear or by the failure of the reversing gear to function properly.

(b) That such accidents with power reverse gear equipped engines have included the same types as have occurred on locomotives equipped with manually operated reverse gears, viz, (1) strains, bruises, cuts, broken bones, etc., received in connection with the action of, or the handling of, the reverse gear lever or wheel, in the engine cab, and (2) injuries to enginemen and others while oiling or otherwise attending to locomotives outside of the cab. The evidence in this case discloses more numerous accidents of the former type with hand reverse gears, and of the latter type more numerous accidents and much more serious injuries, including several deaths, resulting from operation of power reverse gears.

(c) That several types of accidents have occurred in the operation of locomotives equipped with power reverse gear due to the absence of, or insufficient amount of, air pressure, causing the reverse gear to be inoperative (which have not occurred and cannot occur in operating engines equipped with manually operated reverse gears), a number of which accidents have resulted in serious personal injuries and/or deaths of employees.

(d) That in numerous instances around terminals, when engines moved without sufficient air supply to operate the brakes they were readily controlled by emergency use of the manually operated
21 reverse gear for braking purposes and serious accidents prevented, whereas in numerous instances under similar circumstances engines equipped with power reverse gear have been uncontrollable, due to the reverse gear being inoperative for the same reason and at the same time the brakes were inoperative. As a result thereof, numerous accidents have occurred in the way of collisions, engines running into turntable pits, through roundhouse walls, into shops, etc., in which serious personal injuries and deaths of employees have resulted, and serious property damages have occurred, with power reverse equipped engines, which would have been preventable had they been equipped with hand reverse gears.

(e) That in cases of loss of air supply, rendering inoperative air brake facilities, on power reverse gear equipped engines running light—i.e., without cars attached—on descending grades there have been several collisions and derailments with resultant loss of life, serious personal injury, and serious property damage, as well as great danger to other trains and passengers thereon, which could have been avoided had those engines been equipped with manually operated reverse gears, by using same as an emergency measure for braking purposes, the power reverse gear being unavailable for that purpose when air supply sufficient to reverse the engine is not available.

(f) That power reverse gears, being more complicated devices than manually operated reverse gears and composed of several times greater number of parts, many of which must be maintained so as to prevent leakage of air held under high pressure, require several times as much attention as manually operated reverse gears in their maintenance, and any slight deviation from perfect condition will result in excessive creeping or other erratic performance, which is not true with manually operated reverse gears.

(g) That numerous accidents have occurred because of the creeping of power reverse gears and in connection with efforts of
22 enginemen and other employes to repair or adjust same to overcome this creeping, which have resulted in serious and permanent personal injuries, followed in one case by death of the engineer. Such experiences have not occurred with manually operated reverse gears because creeping does not occur with such type of gear.

(h) That the accident evidence in this case shows that the great majority of injuries occurring on locomotives equipped with hand reverse gears are composed of strains and minor cuts and bruises such as customarily occur in any line of work involving any degree of physical activity in the ordinary operation of machinery and are necessarily involved therein because of the element of human fallibility. With 2 or 3 exceptions the injuries shown to have resulted

in connection with the use of manually operated reverse gears were temporary in nature and the large majority of them were extremely trivial, resulting in only a few days' loss of time. On the other hand, nine deaths are shown to have resulted from the operation of locomotives equipped with power reverse gears, and a considerable number of permanent and serious personal injuries to have resulted from such operation, none of which deaths or injuries would have occurred had the locomotives at the time been equipped with manually operated reverse gears.

(i) That the number of accidental injuries reported to the Commission's Bureau of Statistics and filed by the Bureau under the classification "Reverse lever, operating", as well as all accidental injuries reported, has decreased rapidly within the 6 years ending with the year 1930, due to educational work and persistent effort of the "Safety First" committees on the various railroads.

(j) That the above mentioned classification of the Bureau of Statistics includes accidents on locomotives equipped with manually operated reverse gears and those equipped with power reverse gears, but because of the nature of accidents with power reverse equipment a great many such accidents are not filed under the above classification, or any other single classification, but are scattered
23 throughout all of the numerous classifications of the Bureau statistics, and therefore no statistics are available to show how numerous such accidents are and whether or not they have decreased in recent years as fast as accidents occurring on engines equipped with manually operated reverse gears. In this situation there is no way of determining the comparative total numbers of power reverse and hand reverse gear accidents.

(k) That the present rule (no. 157) respecting reversing gears was considered adequate when approved by this Commission in 1915, and the evidence in this case fails to show that conditions now with respect to manually operated reverse gears are any worse from the standpoint of safe operation of locomotives than at that time. On the contrary, the evidence shows very great improvement in conditions with respect to the design, maintenance, care, and operation of manually operated reverse gears as they now exist compared to 1915, and as mentioned above a progressive decline in accidental injuries incurred in any way in relation to the operation of hand reverse gears.

(l) That power reverse gears were neither developed nor applied to promote safety nor have they done so.

(m) That the application of power reverse gears to locomotives has been due to the increasing width of the fire box and boiler head on modern locomotives of the larger types having an increasing number of appurtenances and controls for the use of the engineer within the cab, combined with the impossibility of making the cab larger on account of outside clearance limitations.

(n) That in several respects power reverse gear does not make for safety as much as does the hand reverse gear, although a locomotive equipped with either type of gear properly installed and maintained is in proper condition and safe to operate without unnecessary peril to life and limb.

(o) That engineers and firemen suffer fewer personal injuries from all causes than any other train service employes, except train baggagemen.

24 (p) That all the accident evidence which complainants produced before the Commission showed no death caused by or due to the operation of hand reverse gears, and all but a very few of such accidents produced only minor personal injuries. The only accident shown by complainants which resulted in death was a case where a hostler running an engine was unsuccessful in using the hand reverse gear for emergency braking purposes in circumstances under which a power reverse gear would have been wholly unavailable for such purpose.

(q) That the auxiliary steam connection to the power reverse gear has in many instances proven ineffective; that it is unsuitable for use in an emergency requiring immediate action; that in many cases of breakage it cannot be used at all; that it causes the power reverse gear to freeze and become inoperative in the winter, destroys the cylinder packings in the gear, and for these reasons has been discontinued by some railroads.

(r) That the order, in mentioning serious injuries due to employes being caught with valve gear on locomotives equipped with power reverse gear, ignores the uncontradicted evidence in the case in failing to mention five deaths shown to have occurred from such cause; and in failing to state that the carriers have definitely proven by the evidence in the case the greater ability to detect danger and prevent accident with hand reverse gear where men are in a position to be caught upon an intended movement of the gear.

(s) That the evidence conclusively proves that the engineer does not reverse his engine when it is in motion; that no danger is involved either to him or to men on the ground if he brings his head inside to reverse the engine at a standstill; and that use and operation of locomotives equipped with hand reverse gears has not interfered, and does not interfere, with the engineer's observation of signals, or keeping a lookout, so as to affect safety of operation of the locomotive in any manner.

(t) That definite proof conclusively shows "creeping" of
25 power of reverse gears, impossibility of completely overcoming same, the expense and inefficiency resulting therefrom, and accidents caused thereby.

(u) That in the first new paragraph at the top of page 356, 190 I.C.C., the report ignores and is contrary to a large and forceful volume of evidence of experts, locomotive engineers, and mechanical men of long service, to the effect that in certain well defined respects

hand reverse gears tend toward greater safety in operation of locomotives than do power reverse gears.

(v) That the evidence of 45 accident witnesses on behalf of complainants before the Commission, who testified as to injuries received in connection with operation of manually operated reverse gears, shows an average in these selected cases of only one such injury for each 25 years of active service, and only two of these injuries were serious enough to permanently retire the engineer from service, all others resulting in only temporary disability and in many cases of only a few days' duration. 125 witnesses on behalf of defendants before the Commission, with an aggregate of 3,852 years active service on locomotives, suffered only 4 minor injuries—an average of one injury for each 960 years of service.

(w) That since 1915 annual reports of the chief inspector of accidents investigated by the Bureau of Locomotive Inspection, show that such simple devices as the grate shaker and the squirt hose, on locomotives, have been involved in more injury cases than have reversing gears.

(6) That the Commission by its order fails and refuses to give any effect to the uncontradicted evidence before it having to do with insufficient clearances, and accidents which have resulted therefrom, in the cabs of locomotives now equipped with manually operated reverse gears in the following respects:

(a) That insufficient clearance has been shown only with respect to a very limited number of locomotives, and on the vast majority of engines the evidence shows that the clearances are sufficient
26 and there is ample room in the cab for the engineer to safely and conveniently operate the engine and be in the clear of the reverse lever at all times.

(b) That the more modern types of locomotives with the wide fire boxes and more limited room in the cabs are the ones where the principal difficulty in the matter of clearances has been experienced, and these are the locomotives upon which power reverse gears have already been voluntarily applied by the carriers.

(c) That where improper clearances are shown to exist on engines now equipped with manually operated reverse gear, ample clearances may readily and inexpensively be provided by changing the location of air pipes or brake valves, or other appurtenances in the cab, and moving them further away from the reverse lever, by installing and properly maintaining stop blocks or pins, to prevent the lever at the end of its swing from coming close to the boiler head or back-board of the cab, and by cutting out or rearranging back-boards, so as to provide more room.

(d) That the class of accidents attributable to insufficient clearances, constituting the majority of accidents upon which complainants before the Commission rely, is preventable by the above-mentioned means, and the evidence of other accidents with hand reverse gears shows that they are preventable by means other than installing

power reverse gears, viz, by various practical means within the engineer's control at all times and by installation of inexpensive guards, foot braces, and the like.

## XII

Aside from the above-mentioned lack of jurisdiction and statutory authority in the Commission, and on the theory and allegations of the complaint pursuant to which the order was entered, the order is illegal, arbitrary, unreasonable, beyond the power of the Commission, and hence void, because in so far as the following
27 matters may be considered as findings of fact by the Commission, same are unsupported by any substantial evidence and contrary to the undisputed evidence before the Commission:

(1) The reference to comparative frequency of accidents with hand reverse gears and power reverse gears, respectively, found in the paragraph at the bottom of page 355 and top of page 356, 190 I.C.C., in the report is erroneous, in that it ignores the uncontradicted evidence in the case showing conclusively that all power reverse gear accidents during the years 1929 and 1930 are not by any means included in the tables for those years as mentioned in the report, such power reverse gear accidents not being filed under the classification "Reverse levers, operating" to which the figures mentioned in the report alone refer, and reports respecting such power reverse gear accidents being scattered throughout the other numerous accident classifications of the Bureau of Statistics. The total number of power reverse gear accidents for the years 1929 and 1930 do not appear of record because the totals are not available from Bureau of Statistics' reports or records, the only statistics of this character on reverse gear accidents being those appearing under the classification "Reverse levers, operating" and it was impracticable to examine the many thousands of accident reports which would have been necessary to secure the total number of power reverse gear accidents during those years.

(2) The summary of evidence respecting the auxiliary steam connection to the power reverse gear for emergency use and of accidents due to its failure to function included in the paragraph beginning on page 358 and ending on page 359, 190 I.C.C., in the report is erroneous and incomplete, in that it fails to mention several additional important cases of this character shown of record by uncontradicted evidence, two or more of them involving collisions with resultant serious property damage and personal injuries to trainmen and enginemen, and further, in that it fails to mention that
28 several of these accidents would in all probability have been avoided if the locomotives in question had been equipped with hand reverse gears, by using such gears for braking purposes, and thus being able to control the runaway locomotives, all of which is likewise established by evidence which is uncontradicted except with respect to the Bailey case, wherein question has been raised and conflicting testimony given as to the ability to have control of the loco-

motive had it been equipped with a hand reverse gear because of the Young type of valve gear being used on Bailey's engine, this type differing from all others. And the further facts established of record in this case that the auxiliary steam supply in a number of these serious cases has proven inadequate in the emergency to prevent the accident, should also be stated.

(3) The following portion of the first paragraph on page 359, 190 I.C.C., in the report is erroneous: "The carriers urge that this is a safety feature which may be employed with hand reverse gear but which is absent with power reverse gear, because air pressure is necessary to operate the power reverse gear just as it is necessary to operate the air brakes. This argument is no more forceful against the use of power reverse gear than it would be against the use of power brakes", because the uncontradicted proof introduced by the railroads definitely and positively shows the hand reverse gear has this advantageous and important safety feature which power reverse gear has not, and Complainants' evidence agrees therewith.

(4) The statement of cost per locomotive of applying power reverse gear, found in the last paragraph on page 359, 190 I.C.C., in the report, is slightly in error, the exact average amount proven being $411.68, making the estimated aggregate cost of equipping the locomotives covered by the order approximately $7,500,000.

(5) The statement in the first paragraph on page 360, 190 I.C.C., in the report of Division 6 that "The fault termed 'creeping' causes no accidents * * *" is erroneous and contrary to the
29 uncontradicted evidence showing several personal injuries and one death resulting from this cause.

(6) The next following statement in the report, reading: "If the power reverse gears are properly maintained, we think 'creeping' to any material extent will be eliminated", is erroneous, being directly contrary to the large volume of uncontradicted testimony in this case to the effect that the combined intensive efforts of the railroad managements and power-gear manufacturers have failed to eliminate "creeping" and that this difficulty still exists, and is a serious problem with even the latest types of power reverse gears most recently placed in service.

(7) The next following sentence on page 360, 190 I.C.C., in the report, viz: "As to the ability to detect an obstruction in the valve gear, such as a man's head or arm, by the resistance offered to movement of the hand reverse gear, in time to avoid injury, we do not think such a theory is sound", is erroneous because contrary to the facts established by the uncontradicted evidence in the case showing the greater ability to detect danger and avoid accident in certain cases with hand reverse gear as compared with power reverse gear.

(8) The next following sentence on page 360, 190 I.C.C., in the report, viz: "The matter of power reverse gears becoming inoperative while on the road, due to loss of air pressure, can be taken care of by properly applied and maintained steam connections", is erroneous because contrary to the uncontradicted evidence in the case

showing the difficulties of maintaining and using steam connections to prevent accidents in emergencies, several important cases showing positively this lack of utility of steam connections in emergencies with resultant collisions, serious property damages, and personal injuries, preventable with hand reverse gears.

(9) The next following sentence on page 360, 190 I.C.C., in the report is erroneous because obviously not based on evidence in the case, and further if it be assumed that locomotives equipped with hand reverse gears have moved unexpectedly into roundhouse
30 walls and turntable pits, the uncontradicted evidence shows that this cannot occur with a hand reversed engine because of lack of air pressure to move the gear as in the case of power reverse gear, and the further uncontradicted evidence shows that if a hand reversed engine does start unexpectedly to move when there is insufficient air pressure on the locomotive, there remains the opportunity of controlling it by using the hand reverse gear for braking purposes, which does not exist with a power reversed engine.

(10) The statement in the second paragraph on page 360, 190 I.C.C., in the report that several of the accidents and much of the trouble shown of record on locomotives equipped with power reverse gear occurred with obsolete types of gears, is erroneous, as the undisputed testimony shows that only three minor injuries among all of the accidents shown occurred with obsolete gears, and a very few of the extremely large number of instances of erratic performance of power reverse gear, took place with such gears.

11) The statements contained in the last sentence in the paragraph last above mentioned to the effect that difficulties encountered on such locomotives cannot be reasonably expected with modern installation, is erroneous and contrary to a large volume of undisputed testimony showing numerous difficulties and numerous accidents resulting from and in connection with operation of power reverse gears of the latest types, and further in conflict with the undisputed testimony showing that the latest types of power reverse gears operate on the same general principle as the earlier types of gears, and that the latest types of gears embody only a few minor changes in the details of design as against earlier types.

(12) The statement in the third paragraph on page 360, 190 I.C.C., in the report to the effect that the conclusions reached in the report do not conflict with the principle with reference to the relative importance of serious and fatal injuries heretofore announced by the Commission in Public Utilities Commission of Ohio v.
31 Pennsylvania R. Co., 151 I.C.C. 448, 464, is erroneous because directly opposed to the uncontradicted evidence in this case showing that nine deaths have resulted from operation, or failure to operate, of power reverse gears, while the accidents resulting from locomotive operation with hand reverse gears caused for the most part extremely minor and trivial injuries, with only a very few cases of major personal injuries being shown to have resulted from such operation.

(13) The conclusion of the Commission implied in the third paragraph on page 361, 190 I.C.C., in the report, to the effect that there is a greater liability to accident on heavier locomotives equipped with hand reverse gears than on a lighter locomotives so equipped is erroneous and contrary to the uncontradicted evidence in the case, and there is no evidence whatsoever in this case which would warrant the Commission in drawing a line of demarcation based upon the weights of locomotives on the drivers as is proposed in the report and carried into effect in the order.

(14) The last paragraph on page 361, 190 I.C.C., in the report stating the conclusion that the safety of employees and travelers on railroads requires steam locomotives built after April 1, 1933, to be equipped with power reverse gear is contrary to the uncontradicted evidence in the case and entirely unsupported by the evidence therein.

## XIII

In their petition for reargument and reconsideration before the entire Commission, the railroads represented by the American Railway Association in February 1933, urged as one reason therefor the continued decline in traffic and in net operating income since the close of the hearings before the Commission in the year 1931. In failing and refusing to consider the very great change for the worse which had occurred between the close of the hearings and
32 February 1933, and in refusing the railroads an opportunity to present evidence thereof the Commission acted arbitrarily, unreasonably, and unlawfully, and its order denying the petition aforesaid was, for that reason, illegal and void.

## XIV

The enforcement of the conclusion stated in the Commission's report "that air operated power reverse gear should have a suitable steam connection so arranged and maintained that it can be quickly used in case of air failure", and paragraph (c) of the order of January 5, 1933, as amended by the order of January 28, 1933, would require each of the railroads to make extensive installations and changes upon their respective locomotives already equipped with power reverse gears, which expenditures would aggregate several hundred thousand dollars, and in the case of each of the railroads would constitute a substantial sum of money. Insofar as such steam connections would be required by this order to be installed and maintained upon engines now and heretofore equipped with power reverse gears, the order is arbitrary, unreasonable, and unenforceable because not within the pleadings, nor within the issues involved before the Commission, there being in the complaint no allegations as to the insufficiency or lack of safety of power reverse gears and no complaint with respect to absence or improper maintenance of steam connections to same. The matter of steam connections was not in issue in this case, was not involved in the proceedings and the railroads had no opportunity of presenting evidence with respect to any

proposed requirement that they should install such steam connections. Furthermore, the order fails to differentiate between those types of power reverse gears designed to be operated by means of
33 steam connections in case air pressure is not available and those designed to operate by hand in such case, thus requiring many installations of steam connections to gears not designed for such connections. In these respects the enforcement of the order would constitute a taking of property of each of the railroads without due process of law in violation of the fifth amendment of the United States Constitution.

XV

Aside from the Commission's entire lack of jurisdiction and statutory authority above mentioned, the order is based upon an obvious misconception of the meaning and plain purport of section 2 of the Boiler Inspection Act and a misconception of the issues under the allegations of the complaint before the Commission.

XVI

By virtue of the several matters set forth in this petition, the enforcement of the said order of the Commission would deprive the railroads, and each of them, including each of your petitioners herein, of their property without due process of law, in violation of the fifth amendment of the Constitution of the United States. In this behalf particular reference is made to sections IX to XIV, inclusive, hereof.

XVII

The railroads have approximately 31,500 locomotives now equipped with manually operated reverse gears which have heretofore for many years been operated lawfully and in compliance with the Boiler Inspection Act and in compliance with the rules approved by
34 the Commission thereunder. Such locomotives are susceptible of being so operated by the railroads for a further number of years each, without the application of power reverse gears or auxiliary steam connections, and it is the desire of the railroads in the interests of economy and sound business management to continue to so operate said locomotives so long as the same may be kept serviceable and usable on their respective lines of railway. Many such locomotives were in operation for several years prior to 1915, when the existing code of rules under the Boiler Inspection Act was approved. Many of them are now, or will soon be, in need of class 3 or heavier repairs, and a considerable number are in the shops of the various railroads either awaiting such repairs or actually undergoing such repairs, which cannot be completed before July 1, 1933. If required to equip such locomotives with power reverse gears it would be necessary for the railroads to now order the power reverse gears from the manufacturers of such gears in order to have same delivered in time for installation at the time of making such repairs

in order to comply with the provisions of the Commission's order; also to order, procure, and pay for various other materials needed to make numerous other changes upon said locomotives in order that power reverse gears might be installed thereon and steam connections added thereto as required by said order. The expenditures required at once on behalf of the railroads in these respects would aggregate several hundred thousand dollars, a considerable part of which would be incurred and expended by your petitioners herein.

The railroads also have nearly 29,000 engines already equipped with power reverse gears on which steam connections would have to be provided as required by said order, which would likewise require the purchase of materials immediately and the immediate
35 commencement of a construction program in order that all such locomotives be so equipped prior to July 1, 1933, to comply with the order. The expense involved on the part of the railroads in this behalf would be well in excess of $200,000.00, a substantial part of which would have to be borne by your petitioners herein at this time.

The locomotives above mentioned are now needed and in the immediate future will be needed in the active and ordinary operation of the respective lines of railway now being operated by the railroads and in continuing to render essential public service in the transportation of freight and passengers by means thereof.

Unless the enforcement, operation, and execution of the said order is restrained and suspended during the pendency of this suit, irreparable injury will ensue to the petitioners and to all of the railroads, for which there is no adequate remedy at law, in that they will be compelled under the severe penalties prescribed by the Boiler Inspection Act to immediately expend large sums of money as above set forth, and they will thereafter be under the continuing requirement of expending further sums from time to time as the engines above mentioned are given class 3 or heavier repairs, in order that they may not be charged with and prosecuted for alleged violations of amended rule no. 157, set out in said order; and upon final judgment in this suit vacating, setting aside, and annulling said order and restraining and enjoining the enforcement, operation, and execution thereof, all amounts meantime expended by the railroads to comply with the order and to avoid such prosecution and penalties would be substantially lost because the salvage value of the materials and appliances so purchased and installed in the meantime would not be worth more than the cost of recovering same, except as to
36 the gears themselves, which would have a small used value, and all labor cost expended in such installations would be a complete loss.

Wherefore, since by reason of the facts herein set forth your petitioners are without any adequate remedy at law, petitioners pray:

(a) That a subpoena in chancery issue out of and under the seal of this honorable court, directed to the defendant, as required by law, and that due and proper service of such process and of this

petition be forthwith made by filing a copy thereof in the office of the Secretary of the said Commission and in the Department of Justice, as provided by law, and that thereby the defendant be required, on or before a date to be specified in such subpoena or notice, to appear herein and answer this petition, but not under oath, answer under oath being hereby expressly waived.

(b) That the court, as soon as practicab'e, convene a specially constituted court of three judges, as required by 28 U. S. C. 47, and that a temporary or interlocutory injunction be entered herein, restraining, enjoining and suspending, until the further order of this court, the operation, execution, effect and enforcement of said order of the Commission.

(c) That pending a hearing upon the aforesaid application for a temporary or interlocutory injunction a preliminary restraining order be issued in terms restraining, enjoining and suspending the operation, execution, effect and enforcement of said order of the Commission until said application for a temporary or interlocutory injunction shall have been heard and determined.

(d) That after final hearing this Court adjudge, order and decree that said order of the Commission is and has at all times been beyond the lawful authority of the Commission, and wholly void; and that said order be perpetually vacated, set aside, suspended, and annulled, and the enforcement thereof perpetually restrained and enjoined.

(e) That petitioners, and each of them, may have such other and further relief in the premises as to equity and justice may
37 appertain and as may be deemed by this honorable court to be adequate and proper under the circumstances.

(Sidney S. Alderman),
SIDNEY S. ALDERMAN,
(H. Z. Maxwell),
H. Z. MAXWELL,
(Alfred P. Thom, Jr.),
ALFRED P. THOM, JR.,
(Nye F. Morehouse),
NYE F. MOREHOUSE,
*Attorneys for Petitioners,*
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WILLIAM N. KING,
*Resident Attorney for Petitioners,*
*1324 W. 3rd St., Cleveland, Ohio.*

J. Aronson, M. L. Bell, Henry Wolf Bikle, N. S. Brown, N. S. Buckingham, H. W. Clark, W. R. C. Cooke, John J. Cornwell, Ben C. Dey, F. G. Dorety, R. V. Fletcher, W. L. Kinter, W. H. Lyford, D. F. Lyons, Clarence A. Miller, H. T. Newcomb, W. B. Rodman, Bruce Scott, H. A. Taylor, E. J. White, of Counsel.

38 [*Duly sworn to by Edward Flynn, jurat omitted in printing.*]

39 *Exhibit A to petition*

Before the Interstate Commerce Commission

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants,

*vs.*

ATLANTIC COAST LINE RAILROAD COMPANY AND ALL OTHERS NAMED in the List of Defendants in the Appendix Hereto Attached and Made a Part Hereof (see Appendix), defendants

COMPLAINT

I

The complainants herein respectfully show that the complainant, A. Johnston, is the grand chief engineer of the Brotherhood of Locomotive Engineers and the head and chief executive of said organization; that the Brotherhood of Locomotive Engineers is an organization composed of about 80,000 locomotive engineers in the United States, having as its principal purpose the improvement of working conditions and the promotion of the general welfare of locomotive engineers; that he makes this complaint on behalf
40 of the Brotherhood of Locomotive Engineers and also on behalf of a large number of locomotive engineers, whose names are too numerous to mention herein, who are in the service of the defendant railroad companies; that the complainant, D. B. Robertson, is president of the Brotherhood of Locomotive Firemen and Enginemen, and the head and chief executive of said organization; that the Brotherhood of Locomotive Firemen and Enginemen is an organization composed of about 100,000 locomotive firemen and enginemen in the United States, having as its principal purpose the improvement of working conditions and the promotion of the general welfare of locomotive firemen and enginemen; that he makes this complaint on behalf of the Brotherhood of Locomotive Firemen and Enginemen, and also on behalf of a large number of locomotive firemen and enginemen, whose names are too numerous to mention herein, who are in the service of the defendant railroad companies.

II

That the defendants named herein are common carriers, engaged in the transportation of passengers and/or property, wholly by railroad, or partly by railroad and partly by water, in interstate commerce among the several States, and between the several States and the District of Columbia and foreign countries, and as such common carriers are subject to the provisions of the Interstate Commerce Act as amended and the Boiler Inspection Act as amended.

III

That the defendants are using, or permitting to be used, on their respective lines in the several States and the District of
41 Columbia, in the movement of interstate or foreign traffic, locomotive engines propelled by steam power, without the boilers and tenders of said locomotives and all parts and appurtenances thereof being in proper condition and safe to operate in the service to which the same are put, and without being so equipped that the same may be employed in the active service of such carriers without unnecessary peril to life or limb, in violation of the provisions of section 2 of the Boiler Inspection Act of February 17, 1911, as amended, in the following particulars, to wit: That said locomotives are being so used without the same being equipped with power reverse gear.

IV

That said locomotives, being so operated in violation of said Boiler Inspection Act, as amended, are equipped with manually operated reverse gear; that said manually operated reverse gear is improper, unsuitable, and unsafe, and the use thereof unnecessarily endangers the health, comfort, and general welfare of the engineers and firemen, and subjects the engineers and firemen and other employees of said defendants, the travelling public and travellers on the highways, to unnecessary peril to life or limb in the following particulars, to wit:

Said manually operated reverse gear is inherently improper, unsuitable, and unsafe in principle and design.

Said manually operated reverse gear is excessively heavy and difficult to use, and is beyond the strength of many engineers to operate, and the use thereof subjects the engineers to undue fatigue and physical strain.

Said manually operated reverse gear, and the various parts thereof, frequently break or fail, and cause the reverse lever to go out of control and to strike the engineer with great force and severely injure him.

42 In the event of the breaking, failure, or improper action of other parts or appurtenances of the locomotives, which frequently occurs, particularly in the valve motion, valve chambers, or driving gear, said manually operated reverse gear is subjected to great force and strain, which frequently causes the reverse lever to go out of control and to strike and severely injure the engineer.

The use of said manually operated reverse lever frequently requires the engineer and fireman to leave their usual and proper positions in the engine cab to handle said lever and to place themselves in a hazardous position, and thereby prevents them from performing their other necessary duties, including the observation of signals and the keeping of an effective look-out.

And said manually operated reverse gear generally subjects the employees of the defendants and the traveling public to unnecessary peril to life or limb.

V

That power reverse gear has been developed which is practical, suitable, and safe to use, and is applicable to all locomotives propelled by steam now used or permitted to be used by the defendants herein.

That section 7 of said Boiler Inspection Act provides that the chief inspector shall make an annual report to the Interstate Commerce Commission of the work done during the year, and shall make such recommendations for the betterment of the service as he may desire; that in conformity with said Act the chief inspector in his annual reports to the Interstate Commerce Commission frequently has made recommendations for the adoption of a rule requiring locomotives to be equipped with power reverse gear; that during the period of Federal control the matter of the installation of power reverse gear was before and considered by the Director Gen-
43 eral of Railroads; that said Director General of Railroads required and caused steam locomotives constructed by or for the Government to be equipped with such device; and that a number of railroads have equipped and are now operating a large number of their locomotives with such power reverse gear.

Wherefore, complainants pray that the defendants may be severally required to answer the charges herein; that after due hearing and investigation an order may be made commanding the defendants and each of them to cease and desist from the violation of the Boiler Inspection Act as amended hereinbefore alleged and set forth; that the Commission make and prescribe appropriate rules and regulations for the equipment of all locomotive engines propelled by steam power with power reverse gear, or other devices adequate to protect the employees upon said locomotives from unnecessary peril to life or limb, as provided in section 2 of said Boiler Inspection Act as amended, and that such other and further order or orders be made as the Commission may consider proper in the premises.

Dated at Cleveland, Ohio, this 7th day of November 1930.

A. JOHNSTON,
*Grand Chief Engineer of the Brotherhood of Locomotive Engineers.*
OSCAR J. HORN,
*Counsel.*
D. B. ROBERTSON,
*President of the Brotherhood of Locomotive Firemen and Enginemen.*
THOS. STEVENSON,
*Counsel.*

NOTE.—The appendix, listing more than 900 defendants, is omitted, since the names of the defendant railroads on whose behalf

this suit is brought are shown in the appendices attached to the respective answers printed herewith.

44 *Exhibit B to petition*

(Part 1)

Before the Interstate Commerce Commission

Docket No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE RAILROAD COMPANY ET AL., DEFENDANTS

ANSWER

Now come the respondents, whose names are listed in the appendix hereto attached and made a part hereof, answering herein through the American Railway Association, and, for answer to the complaint in this proceeding, respectfully state:

1. These respondents are without sufficient information to enable them to admit or deny the allegations of paragraph I of said complaint; wherefore said respondents pray that the said complainants be required to make strict proof of the allegations contained in that paragraph, to the extent deemed material and relevant.

2. These respondents admit the allegations of paragraph II of said complaint.

45 3. These respondents admit that locomotives are in use on their several lines not equipped with power reverse gears, but deny the other allegations in said paragraph.

4. These respondents say, in answer to the allegations of the fourth paragraph of the complaint, that, while power reverse gears are suitable and useful in connection with certain classes of locomotives, this is not true of all classes, and that for locomotives in such last mentioned class there is no necessity for such equipment. It is the policy and the practice of these respondents to equip all new locomotives, of the classes where such gears are appropriate, with power reverse gears, and they have so equipped a large number of their locomotives of this class which were already in service. There are many cases, however, in which locomotives will soon be cut up and disappear from the service, and there are others engaged in such a class of service as to obviate the necessity for the use of power reverse gears. It is the policy of these respondents to proceed as

rapidly as possible to equip with this device such of their locomotives as to which such equipment is desirable, and they respectfully submit that this is a matter of management which may be safely left to the carriers themselves.

As is well known to this honorable Commission, the carriers are in no position at this time to be put to the necessity of increased expenses or to make expenditures which are not essential. Part of this is due to the general, world-wide depression in business, which it is hoped will be temporary, but a large part of the depleted condition of their revenues is due to the effects of competition by other agencies of transportation, largely if not entirely unregulated, and at least a substantial part of this competition is likely to be permanent. At a time when it is necessary to make a survey of the entire railroad situation and to adopt every means that is wise
46 and suitable to enable them to continue to furnish adequate transportation to the public, it is believed that it will be unfortunate and against the public interest to create for them necessities for expenditures which can be avoided compatibly with adequate and economical service to the public and proper protection to the employees, as is the case here. To grant the prayer of the petition in this case would involve the expenditure of a very large amount of money. The expenditure of any amounts that are in any case available may be, and are now being, made in other directions which will promote the public and employee welfare and safety in a very much larger degree than that proposed in the complaint.

The employees constitute an integral and essential part of the industry conducted by these respondents, and it is to their interest, as well as to the interest of the security holders of these respondents and of the general public, that expenditures not pressingly necessary should not be required of the carriers at this juncture.

Except as herein stated, the allegations of paragraph IV are denied.

5. These respondents admit that power reverse gears have been produced which are practical, suitable and safe to use, but deny that they are properly applicable to all locomotives propelled by steam now used or permitted to be used by them.

Except as herein answered, the other allegations of paragraph V are irrelevant and immaterial.

Wherefore, the respondents pray that the complaint in this proceeding be dismissed.

Respondents named in Appendix,

By AMERICAN RAILWAY ASSOCIATION,
R. H. AISHTON, *President.*

ALFRED P. THOM,
*General Counsel,*
WASHINGTON, D.C., *January 29, 1931.*

47 APPENDIX

Abilene & Southern Railway Company.
The Ahnapee and Western Railway Company.
The Akron and Barberton Belt Railroad Company.
The Akron, Canton & Youngstown Railway Company.
The Akron Union Passenger Depot Company.
The Alabama Great Southern Railroad Company.
Albany Passenger Terminal Company.
Alton and Southern Railroad.
The Ann Arbor Railroad Company.
Apalachicola Northern Railroad Company.
Arkansas & Louisiana Missouri Railway Company.
Arkansas & Memphis Railway Bridge and Terminal Co.
Asherton and Gulf Railway Company.
Asheville and Craggy Mountain Railway Company.
Asphalt Belt Railway Company.
The Atchison, Topeka and Santa Fe Railway Company.
Atchison Union Depot and Railroad Company.
Atlanta and Saint Andrews Bay Railway Company.
Atlanta and West Point Rail Road Company.
Atlanta, Birmingham and Coast Railroad Company.
Atlanta Terminal Company.
Atlantic and St. Lawrence Railroad Company.
Atlantic and Yadkin Railway Company.
Atlantic City Railroad Company.
Atlantic Coast Line Railroad Company.
Augusta and Summerville Railroad Company.
The Augusta Union Station Company.
Baltimore and Eastern Railroad Company.
The Baltimore and Ohio Railroad Company.
The Baltimore and Ohio Chicago Terminal Railroad Company.

48 Bangor and Aroostook Railroad Company.
Bath and Hammondsport Railroad Company.
The Bay Terminal Railroad Company.
The Beaumont, Sour Lake & Western Railway Company.
Beaumount Wharf and Terminal Company.
Bellefonte Central Railroad Company.
The Belt Line Railway Company.
The Belt Railway Company of Chicago.
Bessemer and Lake Erie Railroad Company.
Big Sandy and Cumberland Railroad Company.
Bingham and Garfield Railway Company.
Birmingham Belt Railroad Company.
Birmingham Southern Railroad Company.
Birmingham Terminal Company.
Black Mountain Railway Company.
Blue Ridge Railway Company.

Bonhomie and Hattiesburg Southern Railroad Company.
Boston and Maine Railroad.
The Boston Terminal Company.
Brownsville & Matamoros Bridge Company.
Buffalo & Susquehanna Railroad Corporation.
Buffalo, Rochester and Pittsburgh Railway Company.
Burlington-Rock Island Railroad Company.
Camas Prairie Railroad Company.
Canadian Pacific Lines in Maine.
Canadian Pacific Lines in Vermont.
Canton & Carthage Railroad Company.
Canton Railroad Company.
Carolina and Tennessee Southern Railway Company.
Central Indiana Railway Company.
Central of Georgia Railway Company.
The Central Railroad Company of New Jersey.
The Central Union Depot and Railway Company of Cincinnati.
Central Vermont Railway, Inc.
49 The Champlain and St. Lawrence Railroad Company (Canadian National Railway Company, Lessee).
Charleston & Western Carolina Railway Company.
Charleston Union Station Company.
Charlotte, Monroe and Columbia Railroad Company.
Chattahoochee Valley Railway Company.
Chattanooga Station Company.
Cherry Tree and Dixonville Railroad Company.
The Chesapeake and Ohio Railway Company.
Chesterfield and Lancaster Railroad Company.
The Chicago and Alton Railroad Company (William W. Wheelock and William G. Bierd, receivers).
Chicago and Calumet River Railroad Company.
Chicago and Eastern Illinois Railway Company.
Chicago and Erie Railroad Company.
Chicago & Illinois Midland Railway Company.
Chicago & Illinois Western Railroad.
Chicago and North Western Railway Company.
Chicago and Western Indiana Railroad Company.
Chicago, Burlington & Quincy Railroad Company.
Chicago Great Western Railroad Company.
Chicago Heights Terminal Transfer Railroad Company.
Chicago, Indianapolis, and Louisville Railway Company.
Chicago, Kalamazoo and Saginaw Railway Company.
Chicago, Milwaukee and Gary Railway Company.
Chicago, Milwaukee, St. Paul and Pacific Railroad Company.
The Chicago River and Indiana Railroad Company.
The Chicago, Rock Island and Gulf Railway Company.
The Chicago, Rock Island and Pacific Railway Company.
Chicago, Saint Paul, Minneapolis and Omaha Railway Company.
Chicago Short Line Railway Company.

Chicago Union Station Company.
Chicago, West Pullman & Southern Railroad Company.
50 Cincinnati, Burnside & Cumberland River Railway Company.
The Cincinnati, New Orleans and Texas Pacific Railway Company.
The Cincinnati Northern Railroad Company.
Cisco & Northeastern Railway Company.
The Cleveland, Cincinnati, Chicago and St. Louis Railway Company.
Clinchfield Railroad Company.
The Colorado and Southern Railway Company.
The Colorado & Wyoming Railway Company.
Columbia, Newberry and Laurens Railroad Company.
Columbia Union Station Company.
Columbus and Greenville Railway Company.
The Cooperstown and Charlotte Valley Railroad Company.
Cornwall Railroad Company.
The Covington and Cincinnati Elevated Railroad and Transfer and Bridge Company.
Cumberland and Pennsylvania Railroad Company.
The Cuyahoga Valley Railway Company.
Dallas Terminal Railway and Union Depot Company.
Danville and Western Railway Company.
Dardanelle & Russellville Railroad Company.
Davenport, Rock Island and North Western Railway Company.
Dayton and Union Railroad Company.
The Dayton Union Railway Company.
Deep Creek Railroad Company.
The Delaware and Hudson Railroad Corporation.
The Delaware, Lackawanna and Western Railroad Company.
The Denison and Pacific Suburban Railway Company.
The Denver and Rio Grande Western Railroad Company.
The Denver Union Terminal Railway Company.
51 Des Moines Union Railway Company.
Detroit and Mackinac Railway Company.
The Detroit and Toledo Shore Line Railroad Company.
Detroit Terminal Railroad Company.
Detroit, Toledo and Ironton Railroad Company.
Duluth, Missabe and Northern Railway Company.
The Duluth, South Shore and Atlantic Railway Company.
The Duluth Union Depot and Transfer Company.
Duluth, Winnipeg and Pacific Railway Company.
Durham and Southern Railway Company.
Durham Union Station Company.
East St. Louis Junction Railroad Company.
Elberton & Eastern Railroad Company.
Elgin, Joliet and Eastern Railway Company.
El Paso Union Passenger Depot Company.

Erie Railroad Company.
Etna and Montrose Railroad Company.
Evansville, Indianapolis & Terre Haute Railway Company.
Farmers Grain and Shipping Company.
Flint Belt Railroad Company.
Flint River and Northeastern Railroad Company.
Florida Central and Gulf Railway.
Florida East Coast Railway Company.
Fonda, Johnstown and Gloversville Railroad Company.
Fort Smith and Western Railway Company.
The Fort Street Union Depot Company.
Fort Wayne Union Railway Company.
Fort Worth and Denver City Railway Company.
Fort Worth & Rio Grande Railway Company.
Fort Worth Union Passenger Station Company.
Fulton Chain Railway Company.
The Gainesville and Northwestern Railroad Company (G. A. Austin and Sidney Smith, receivers).
52 Gales Creek & Wilson River Railroad Company.
Galveston, Houston and Henderson Railroad Company.
Galveston Terminal Railway Company.
Genessee and Wyoming Railroad Company.
Georgia, Ashburn, Sylvester & Camilla Railway Company.
The Georgia Northern Railway Company.
Georgia Railroad, Lessee Organization.
Georgia Southern and Florida Railway Company.
The Gilmore and Pittsburgh Railroad Company, Limited.
Goldsboro Union Station Company.
Grand Trunk Western Railroad Company.
Great Northern Railway Company.
The Great Western Railway Company.
Green Bay and Western Railroad Company.
Greenwich & Johnsonville Railway Company.
Gulf and Ship Island Railroad Company.
Gulf, Colorado and Santa Fe Railway Company.
Gulf, Mobile and Northern Railroad Company.
Gulf Terminal Company.
Hannibal Union Depot Company.
Harlem Transfer Company.
Harriman and Northeastern Railroad Company.
High Point, Thomasville & Denton Railroad Company.
Hoboken Manufacturers' Railroad Company.
Holton Inter-Urban Railway Company.
Houston and Brazos Valley Railway Company.
Houston Belt & Terminal Railway Company.
The Huntingdon and Broad Top Mountain Railroad and Coal Company.
Illinois Central Railroad Company.

Illinois Northern Railway.
Illinois Terminal Company.
Indiana Harbor Belt Railroad Company.
The Indianapolis Union Railway Company.
53 International Bridge Company.
International-Great Northern Railroad Company.
Interstate Railroad Company.
The Ironton Railroad Company (Lehigh Valley Railroad Company, Reading Company, lessees).
Jacksonville, Gainesville & Gulf Railway.
Jacksonville Terminal Company.
Johnstown and Stony Creek Rail Road Company.
Joliet Union Depot Company.
Joplin Union Depot Company.
Kanawha, Glen Jean and Eastern Railroad Company.
Kankakee and Seneca Railroad Company.
The Kansas & Oklahoma Railway Company (H. J. Duvall, receiver).
The Kansas City, Mexico and Orient Railway Company.
The Kansas City Southern Railway Company.
Kansas City Terminal Railway Company.
Kansas, Oklahoma & Gulf Railway Company.
Keokuk Union Depot Company.
Kewaunee, Green Bay and Western Railroad Company.
The Lake Erie & Eastern Railroad Company.
The Lake Erie and Fort Wayne Railroad Company.
Lake Superior & Ishpeming Railroad Company.
The Lake Superior Terminal and Transfer Railway Company of the State of Wisconsin.
The Lake Terminal Railroad Company.
The Leavenworth Depot and Railroad Company.
The Leavenworth Terminal Railway and Bridge Company.
The Lehigh and Hudson River Railway Company.
Lehigh and New England Railroad Company.
Lehigh Valley Railroad Company.
Lewiston and Auburn Railroad Company.
Litchfield and Madison Railway Company.
54 Live Oak, Perry & Gulf Railroad Company.
The Long Island Railroad Company.
The Lorain & West Virginia Railway Company.
Los Angeles & Salt Lake Railroad Company.
Louisiana & Arkansas Railway Company.
Louisiana, Arkansas & Texas Railway Company.
Louisiana Southern Railway Company.
Louisville and Jeffersonville Bridge and Railroad Company.
Louisville and Nashville Railroad Company.
Louisville and Wadley Railroad Company.
Macon, Dublin & Savannah Railroad Company.
Macon Terminal Company.

Magma Arizona Railroad Company.
Maine Central Railroad Company.
Manistee and Northeastern Railway Company.
Mantistique and Lake Superior Railroad Company.
Marion and Southern Railroad Company.
Maryland and Pennsylvania Railroad Company.
McCloud River Railroad Company.
McKeesport Connecting Railroad Company.
Memphis Union Station Company.
Meridian Terminal Company.
The Michigan Central Railroad Company.
Middletown and Unionville Railroad Company.
Midland Continental Railroad.
Midland Valley Railroad Company.
Mineral Range Railroad Company.
The Minneapolis & St. Louis Railroad Company (W. H. Bremner, receiver).
Minneapolis Eastern Railway Company.
Minneapolis, Northfield and Southern Railway.
Minneapolis, Red Lake and Manitoba Railway Company.
Minneapolis, St. Paul & Sault Ste. Marie Railway Company.
55 Minnesota and International Railway Company.
The Minnesota Transfer Railway Company.
Minnesota Western Railroad Company.
Mississippi Central Railroad Company.
Missouri and Illinois Bridge and Belt Railroad Company.
Missouri-Kansas-Texas Railroad Company.
Missouri-Kansas-Texas Railroad Company of Texas.
Missouri Pacific Railroad Company.
Mobile and Ohio Railroad Company.
The Monongahela Railway Company.
Montour Railroad Company.
The Muncie Belt Railway Company.
The Nashville, Chattanooga & St. Louis Railway.
Natchez & Southern Railway.
The Natchez, Columbia and Mobile Railroad Company.
Nevada Northern Railway Company.
New Iberia & Northern Railroad Company.
The New Jersey and New York Railroad Company.
New Jersey, Indiana & Illinois Railroad Company.
New Orleans and Lower Coast Railroad Company.
New Orleans and Northeastern Railroad Company.
New Orleans Great Northern Railroad Company.
New Orleans, Natalbany and Natchez Railway Company.
New Orleans Terminal Company.
New Orleans, Texas & Mexico Railway Company.
The New York and Long Branch Railroad Company.
The New York Central Railroad Company.

The New York, Chicago and St. Louis Railroad Company.
The New York Connecting Railroad Company.
The New York, New Haven and Hartford Railroad Company.
New York, Ontario and Western Railway Company.
New York, Susquehanna and Western Railroad Company.
56 Norfolk and Western Railway Company.
The North and South Railway Company (R. E. McNally, receiver).
North Charleston Terminal Company.
Northern Alabama Railway Company.
Northern Pacific Railway Company.
The Northern Pacific Terminal Company of Oregon.
Northwestern Pacific Railroad Company.
Northwestern Railroad Company of South Carolina.
The Ogden Union Railway and Depot Company.
The Ohio River and Western Railway Company.
Oklahoma City-Ada-Atoka Railway Company.
The Orange & Northwestern Railroad Company.
Oregon, California & Eastern Railway Company.
Oregon Short Line Railroad Company.
Oregon Trunk Railway.
Oregon-Washington Railroad & Navigation Company.
Osage Railway Company.
The Owasco River Railway.
Paducah & Illinois Railroad Company.
Panhandle and Santa Fe Railway Company.
Paris and Mt. Pleasant Railroad Co. (R. W. Wortham, receiver).
Patapsco & Back Rivers Railroad Company.
The Pecos Valley Southern Railway Company.
Pennsylvania and Atlantic Railroad Company.
The Pennsylvania Railroad Company.
Peoria and Pekin Union Railway Company.
Peoria Terminal Company.
Pere Marquette Railway Company.
Philadelphia and Beach Haven Railroad Company.
Philadelphia, Bethlehem and New England Railroad Company.
Pittsburgh, Allegheny & McKees Rocks Railroad Company.
57 The Pittsburgh and Lake Erie Railroad Company.
The Pittsburg & Shawmut Railroad Company.
The Pittsburgh & West Virginia Railway Company.
Pittsburgh, Chartiers & Youghiogheny Railway Company.
The Pittsburgh, Lisbon & Western Railroad Company.
The Pittsburg, Shawmut and Northern Railroad Company (John D. Dickson, receiver).
Portland Terminal Company.
The Prescott and Northwestern Railroad Company.
The Pueblo Union Depot and Railroad Company.
Pullman Railroad Company.

Quincy, Omaha & Kansas City Railroad Company.
The Railway Transfer Company of the City of Minneapolis.
Raleigh & Charleston Railroad Company.
Raquette Lake Railway Company.
Raritan River Rail Road Company.
Reading Company.
Richmond, Fredericksburg and Potomac Railroad Company.
Richmond Terminal Railway Company.
Rio Grande City Railway Company.
Rock Island-Frisco Terminal Railway Company.
Rosslyn Connecting Railroad Company.
Rutland Railroad Company.
St. Clair Tunnel Company.
St. Johns River Terminal Company.
The St. Joseph and Grand Island Railway Company.
St. Joseph Belt Railway Company.
St. Joseph Terminal Railroad Company.
St. Joseph Union Depot Company.
The St. Louis, Brownsville and Mexico Railway Company.
58 St. Louis, San Francisco and Texas Railway Company.
St. Louis-San Francisco Railway Company.
St. Louis Southwestern Railway Company.
St. Louis Southwestern Railway Company of Texas.
The Saint Paul Union Depot Company.
Sainte Marie Union Depot Company.
The Salt Lake City Union Depot and Railroad Company.
San Antonio Southern Railway Company.
San Antonio, Uvalde & Gulf Railroad Company.
San Benito and Rio Grande Valley Railway Company.
San Diego and Arizona Railway Company.
The San Luis Valley Southern Railway Company.
Saratoga & Encampment Valley Railroad Company.
Sault Ste. Marie Bridge Company.
Savannah and Statesboro Railway Company.
Savannah River Terminal Company.
Savannah Union Station Company.
Schoharie Valley Railway Company.
Seaboard Air Line Railway Company.
The Shreveport Bridge & Terminal Company.
Sievern and Knoxville Railroad Company.
Sioux City Bridge Company.
Sioux City Terminal Railway Company.
Southern Illinois & Missouri Bridge Company.
Southern Pacific Company.
Southern Railway Company.
Spokane International Railway Company.
Spokane, Portland and Seattle Railway Company.

The Staten Island Rapid Transit Railway Company.
State University Railroad Company.
Steelton & Highspire Railroad Company.
Sugar Land Railway Company.
Sunset Railway Company.
Sylvania Central Railway Company.
59 Tallulah Falls Railway Company (J. F. Gray, Receiver).
Tampa Northern Railroad Company.
Tampa Union Station Company.
Tavares and Gulf Railroad Company.
Tennessee and Carolina Southern Railway Company.
Tennessee Central Railway Company.
Terminal Railway Alabama State Docks.
Texarkana and Fort Smith Railway Company.
Texas and New Orleans Railroad Company.
The Texas and Pacific Railway Company.
Texas City Terminal Railway Company.
Texas-New Mexico Railway Company.
Texas Pacific-Missouri Pacific Terminal Railroad of New Orleans.
Texast Short Line Railway Company.
Toledo, Peoria & Western Railroad.
Tonopah and Tidewater Railroad Company.
The Troy Union Railroad Company.
Union Depot Company (Columbus, Ohio).
Union Freight Railroad Company.
Union Pacific Railroad Company.
The Union Passenger Depot Co. of Galveston.
Union Railroad Company (Pittsburgh, Pa.).
Union Railway Company (Memphis, Tenn.).
The Union Stock Yard & Transit Company of Chicago.
The Union Terminal Company (Dallas, Texas).
Union Terminal Railway Company (St. Joseph, Mo.).
United Railways Company (Portland, Ore.).
The United States and Canada Railroad Company (Canadian National Railway Company, Lessee).
Unity Railways Company.
Upper Merion and Plymouth Railroad Company.
Utah Railway Company.
Van Buren Bridge Company.
Vermont and Province Line Railroad Company.
60 Virginia and Carolina Southern Railroad Company.
The Virginian Railway Company.
Wabash Railway Company.
Wadley Southern Railway Company.
Warren & Ouachita Valley Railway Company.
Washington, Idaho & Montana Railway Company.
The Washington Terminal Company.

Waynesburg and Washington Railroad Company.
The Weatherford, Mineral Wells and Northwestern Railway Company.
Western Allegheny Railroad Company.
Western Maryland Railway Company.
The Western Pacific Railroad Company.
The Western Railway of Alabama.
West Jersey and Seashore Railroad Company.
The Wheeling and Lake Erie Railway Company.
White Sulphur Springs & Yellowstone Park Railway Company.
The Wichita Union Terminal Railway Company.
The Wichita Valley Railway Company.
Wildwood and Delaware Bay Short Line Railroad Company.
Wilkes-Barre and Eastern Railroad Company.
Wilkes-Barre Connecting Railroad Company.
Willimsport & North Branch Railway Co.
Winona Bridge Railway Company.
Winston-Salem Southbound Railway Company.
Winston-Salem Terminal Company.
Wood River Branch Railroad Company.
Woodstock & Blocton Railway Company.
Wrightsville and Tennille Railroad Company.
Yadkin Railroad Company.
The Yazoo and Mississippi Valley Railroad Company.
The Youngstown and Northern Railroad Company.

61 *Exhibit B to petition*

(Part 2)

Before the Interstate Commerce Commission

Docket No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE RAILROAD COMPANY ET AL., DEFENDANTS

AMENDED AND SUPPLEMENTAL ANSWER

Now come the respondents, whose names are listed in the appendix to the original answer in this proceeding, answering herein through the American Railway Association, and for further answer to the complaint in this proceeding, respectfully state:

That a power reverse gear is not a safety device or appliance within the meaning of section 2 of the Boiler Inspection Act of February 17, 1911, as amended, and that the Interstate Commerce Commission is without jurisdiction to entertain the complaint in this proceeding.

62 Wherefore, the respondents pray that the complaint be dismissed for want of jurisdiction.

Respondents named in appendix to original answer.

By AMERICAN RAILWAY ASSOCIATION,
R. H. AISHTON, *President.*

ALFRED P. THOM,
*General Counsel.*
WASHINGTON, D.C., *March 12, 1931.*

63 *Exhibit B to petition*

(Part 3)

Before the Interstate Commerce Commission

Docket No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE RAILROAD COMPANY ET AL., DEFENDANTS

AMENDED AND SUPPLEMENTAL ANSWER

Now come the respondents, whose names are listed in the appendix to the original answer in this proceeding, answering herein through the American Railway Association, and, as supplemental to and for further answer to the complaint in this proceeding, respectfully state:

I

In the original answer filed herein the following statement was made:

5. These respondents admit that power reverse gears have
64 been produced which are practical, suitable, and safe to use, but deny that they are properly applicable to all locomotives propelled by steam now used or permitted to be used by them.

Since that answer was filed, additional and more careful study has been given to the subject of power reverse gears and expert opinions in respect to them have been sought and compared. As a result, the respondents believe that said paragraph 5 should be modified as herein indicated and they accordingly respectfully state in respect thereto:

That power reverse gears which have heretofore been and are now being produced are the result of several years of experimentation, during which time numerous changes in methods and types have been adopted; that none heretofore produced and used have been found to be perfect, and further experimentation and changes are being carried out at the present time in an endeavor to further perfect said devices. That while respondents have heretofore caused numerous locomotives to be equipped with power reverse gears in the hope and expectation that same would prove to be suitable and practicable in use upon locomotives so equipped, in numerous instances it has been found that such gears were so unsuitable and impracticable in actual use that it has become necessary to remove same, while in many other instances such gears while still in use have proven to be so defective and so expensive of operation as to be of doubtful suitability.

II

That this Commission following the enactment of said Boiler Inspection Act and the first amendment thereof, had before it certain rules and instructions for the inspection and testing of steam locomotives and tenders and parts and appurtenances thereof, said
65 rules and instructions having been prepared by the chief inspector pursuant to section 5 of said act; and after due consideration the Commission approved same. Thereafter from time to time changes of said rules and instructions made at the request of the carriers have been approved by the Commission.

That said rules and instructions as thus changed from time to time contain no provisions with respect to power reverse gears, and this Commission is without authority or jurisdiction to make any rules or instructions with respect to power reverse gears under the said Boiler Inspection Act as amended, the Commission's authority under said act at the present time being limited to approval or disapproval of changes in the rules and instructions which may be submitted to it for approval pursuant to section 5 of said act.

III

That the said Boiler Inspection Act, as amended, provides that in case any district inspector shall in the performance of his duty find any locomotive or tender, or part thereof, not conforming to the requirements of the law, or the rules and regulations approved thereunder by the Commission, the said inspector shall have the right to give notice thereof to the carrier and require same to be withdrawn from service, the carrier then having the right to appeal from such notice and decision to the chief inspector and then to the Commission itself, pending which time the equipment must remain out of service; that the carriers are also subject to penalties of $100 for every violation of such act as provided in section 9

thereof; that these remedies and means are the only means provided for the enforcement of the act and the rules and instructions thereunder, and that no right is given in said act to require the
66 carriers as a whole to be brought in to answer charges as prayed for in the complaint herein, nor for the Commission to enter an order requiring carriers to cease and desist from violating the act as prayed for in said complaint.

IV

That under the said Boiler Inspection Act, as amended, the means provided for enforcement thereof has to do exclusively with each individual locomotive and its condition at any particular time when it is alleged not to be in proper condition and safe to operate as required by the act; and this Commission is without any authority in law to entertain this complaint, to proceed with a hearing in this matter, or to grant the relief requested in the complaint filed herein, or any part thereof.

Wherefore, respondents pray that the complaint be dismissed.

Respondents named in appendix to original answer.

By AMERICAN RAILWAY ASSOCIATION,
R. H. AISHTON, *President.*

ALFRED P. THOM,
*General Counsel.*
WASHINGTON, D.C., *May 11, 1931.*

67 *Exhibit B to petition*

(Part 4)

BEFORE THE INTERSTATE COMMERCE COMMISSION

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE RAILROAD COMPANY ET AL., DEFENDANTS

Docket No. 24050

ANSWER OF DESIGNATED SHORT LINES

The Aberdeen & Rockfish Railroad Company and other carriers named in appendix A and appendix B hereto, commonly called "short lines", appearing herein by the American Short Line Railroad Association, for answer to the complaint in this proceeding respectively state:

I

They admit, on information and belief, the allegations of paragraph I.

II

They admit the allegations of paragraph II.

68 III

The defendants named in appendix A admit that they are using locomotive engines propelled by steam power on their respective lines and that said locomotives are being so used without the same being equipped with power reverse gear, but they specifically deny all the other matters and things in paragraph III and demand strict proof thereof.

The defendants named in appendix B deny each and all of the allegations in paragraph III and demand strict proof thereof.

IV

The defendants admit that the steam locomotives operated by them are equipped with manually operated reverse gear but specifically deny each and all of the other matters and things alleged in paragraph IV and demand strict proof thereof.

V

The defendants admit that section 7 of the Boiler Inspection Act provides that the chief inspector shall make an annual report to the Interstate Commerce Commission of the work done during the year and shall make such recommendations for the betterment of the service as he may desire. These defendants respectively have no knowledge nor such information as enables them to form a belief as to all the other matters and things alleged in paragraph V, hence neither admit nor deny the same, but if they be material, demand strict proof thereof.

VI

69 The defendants named in appendix B allege and show to the Commission that the locomotives used by them are not propelled by steam power, but, to the contrary, are locomotives propelled by electric or gasoline power, hence are not equipped with power reverse gear such as are required and used on locomotives propelled by steam power, and not susceptible to reverse gear equipment such as the complainants seek to compel carriers, whose locomotives are operated with steam power, to install by their complaint filed herein.

## VII

And for further answer these defendants allege and show to the Commission that they are all what are commonly called "short line railroads"; that on account of the great and constantly increasing competition from automobile or vehicular transportation, together with the fact that their earning power is at all times small and uncertain on account of the thinness of traffic and the further fact that they are dependent upon the industrial and other conditions in the limited territory served by them, their financial condition is such that the expense, which would be necessary if they are required to install power reverse gear, would be altogether unreasonable and, in any event, so unreasonable as compared with any benefits that might result as that it would be, in effect, the taking of their property without due process and just compensation, in violation of the fifth amendment to the Constitution.

The defendants named in appendix A allege and show to the Commission that the steam locomotives operated by them are small, being in all cases greatly less than the weight and size of locomotives used on the lines of major carriers, and that such engines are run at a slow speed and for such limited distance and with such light tonnage as that they are entirely safe and adequate as now equipped and the manually operated reverse gear in use by them is not heavy or difficult to use and is not beyond the strength of the engineers to operate and does not and cannot subject such engineers to undue fatigue and physical strain.

They further allege and show that the size and service performed by the locomotives used by them on their respective lines and the speed of trains are so slow and the tonnage carried so light as that the duties performed by the engineers and firemen are not in any wise hazardous or burdensome, and the proper and safe performance of their duties are in no way prevented, nor does the manually operated reverse gear used by these defendants subject either the employees or the traveling public to unnecessary peril to life or limb. That if any of the carriers made defendant in this proceeding are, in fact, using locomotives of such size and/or construction as are unsafe or would subject the engineer and fireman, the employees of the defendants, and/or the traveling public to unnecessary peril to life or limb, any order made herein should apply to locomotives of such a class but should not include locomotives of the size and character of service for which the locomotives of these defendants are used.

Wherefore, the defendants pray that the prayer of the plaintiffs herein be denied and that as to them the said complaint be dismissed.

THE AMERICAN SHORT LINE RAILROAD ASSOCIATION,
By BEN B. CAIN,
*General Counsel.*
CLARENCE A. MILLER,
BEN. B. CAIN, JR.,
*Assistants to General Counsel.*

71 APPENDIX A

Aberdeen and Rockfish Railroad Company.
The Akron, Canton & Youngstown Railway Company.
Alabama Central Railroad Company.
Alabama Central Railway.
Alabama, Florida & Gulf Railroad Company (R. D. Crawford and W. W. Beall, receivers).
Alabama, Tennessee and Northern Railroad Corporation.
Angelina & Neches River Railroad Company.
The Apache Railroad Company.
Appalachian Railway Company.
Arcade and Attica Railroad Corporation.
Arcadia and Betsey River Railway Company.
Arizona Southern Railroad Company.
Arkansas Railroad Company.
Artemus-Jellico Railroad Company.
Ashland Railway Company.
Atlantic and Western Railway Company.
Atlantic Northern Railway Company.
Augusta Railroad Company.
Augusta Northern Railway.
Beaver Valley Railroad Company.
Belfast and Moosehead Lake Railroad Company.
Bennettsville and Cheraw Railroad Company.
The Big Creek and Telocaset Railroad Company.
Birmingham & Southeastern Railroad Company.
Blue Ridge Railway Company.
Bonlee and Western Railway Company.
Bowdon Railway Company.
Brookings & Peach Orchard Railroad Co.
Buffalo, Union-Carolina Railroad.
72 Cadiz Railroad Company.
California Central Railroad Company.
Cambria and Indiana Railroad Company.
Canton & Carthage Railroad Company.
Cape Fear Railways, Incorporated.
Cape Girardeau Northern Railway Company (Gordon W. Cross, receiver).
Carolina and Northeastern Railroad Company.
Carolina and Northwestern Railway Company.
The Carolina Southern Railway Company.
Carolina Western Railroad.
Chattahooche Valley Railway Company.
Chesapeake Beach Railway Company.
Chesapeake Western Railway.
Chicago, Attica & Southern Railroad Company.
Chicago, Springfield & St. Louis Railway Company.

Christie and Eastern Railway Company.
The Clarendon and Pittsford Railroad Company.
Cliffside Railroad Company.
Collins & Glennville Railroad Company.
The Colorado and Southeastern Railroad Company.
The Colorado-Kansas Railway Company.
Columbia & Cowlitz Railway Company.
Coudersport and Port Allegany Railroad Company.
Cowlitz, Chehalis & Cascade Railway.
Craig Mountain Railway Company.
The Dansville and Mount Morris Railroad Company.
Danville and Western Railway Company.
DeKalb & Western Railroad Company.
Dents Run Railroad Company.
DeQueen and Eastern Railroad Company.
East Carolina Railway.
East Kentucky Southern Railway Company.
East Jersey Railroad and Terminal Company.
East Texas and Gulf Railway Company.
73 Elberton & Eastern Railroad Company.
Elkin & Alleghany Railroad Company.
Erie & Michigan Railway & Navigation Co.
Escanaba and Lake Superior Railroad Company.
Ettrick Railroad Company.
Ferdinand Railroad Company.
Fernwood, Columbia & Gulf Railroad Company.
Flemingsburg and Northern Railroad Company.
Flint River and Northeastern Railroad Company.
Fonda, Johnstown and Gloversville Railroad Company.
Fort Smith, Subiaco & Rock Island Railroad Company.
Frankfort and Cincinnati Railroad Company.
The Gainesville and Northwestern Railroad Company (G. A. Austin and Sidney Smith, receivers).
Gainesville Midland Railway (Gordon C. Carson and W. B. Veazey, receivers).
Garyville Northern Railroad Company.
Georgia & Florida Railroad (W. V. Griffin and H. W. Purvis, receivers).
Georgia, Ashburn, Sylvester & Camilla Railway Company.
The Georgia Northern Railway Company.
The Georgia Southwestern and Gulf Railroad Company.
Grasse River Railroad Corporation.
The Greene County Railroad Company.
Greenville and Northern Railway Company.
Groveton, Lufkin & Northern Railway Company.
Hampton & Branchville Railroad Company.
Hartwell Railway Company.
Hawaii Consolidated Railway, Ltd.
Hickory Valley Railroad Company.

High Point, Randleman, Asheboro and Southern Railroad Company.
74 High Point, Thomasville & Denton Railroad Company.
Hillsboro and North Eastern Railway Company.
Hooppole, Yorktown and Tampico Railroad Company.
Howard Terminal Railway.
Indian Valley Railroad Company.
Intermountain Railway Company.
Jacksonville & Havana Railroad Company.
Jefferson Southwestern Railroad Company.
The Kanawha Central Railway Company.
Kane and Elk Railroad Company.
The Kansas and Sidell Railroad Company.
Kellys Creek Railroad Company.
Kentucky & Tennessee Railway.
Kishacoquillas Valley Railroad Company.
Koolau Railway Company, Limited.
Kosciusko & Southeastern Railroad Company.
Lake Champlain and Moriah Rail Road Company.
Lake Erie, Franklin & Clarion Railroad Company.
Lakeland Railway.
The Lakeside and Marblehead Railroad Company.
Lancaster and Chester Railway Company.
L'Anguille River Railway Company.
Laona & Northern Railway Company.
The LaSalle and Bureau County Railroad Company.
Laurinburg and Southern Railroad Company.
Lawndale Railway & Industrial Company.
Ligonier Valley Rail Road Company.
The Little River Railroad Company.
Live Oak, Perry & Gulf Railroad Company.
The Lorain and Southern Railroad Company.
The Louisiana & Pine Bluff Railway Company.
Louisiana Southern Railway Company.
75 Louisville, New Albany and Corydon Railroad Company.
Lufkin, Hemphill and Fulf Railway Company.
Manchester and Oneida Railway Company.
The Mansfield Railway & Transportation Company.
The Marianna & Blountstown Railroad Company.
Marinette, Tomahawk & Western Railroad Company.
Marion Railway Corporation.
Maryland and Delaware Coast Railway Company.
Maxton, Alma and Southbound Railroad Company.
Midland Continental Railroad.
Milstead Railroad Company.
Minneapolis & Rainy River Company.
Mississippi & Alabama Railroad Company.
Mississippi & Skuna Valley Railroad Company.
Mississippi Export Railroad Company.

Missouri and North Arkansas Railway Company (W. Stephenson, receiver).
Montana, Wyoming & Southern Railroad Company.
Morehead and North Fork Railroad Company.
Moshassuck Valley Railroad Company.
Mount Jewett, Kinzua and Riterville Railroad Company.
The Nacogdoches & Southeastern Railroad Company.
The Narragansett Pier Railroad Company.
Nashville and Atlantic Railroad Company.
The Natchez, Columbia and Mobile Railroad Company.
The Natchez, Urania and Ruston Railway Company.
Nelson & Albemarle Railway Company.
The Nevada Central Railroad Company.
The New Mexico Midland Railway Company.
New Orleans, Natalbany and Natchez Railway Company.
New York and Pennsylvania Railway Company.
76 New York Dock Railway.
Nezperce & Idaho Railroad Company.
Northwestern Railroad Company of South Carolina.
Ohio & Kentucky Railway Company (Guy W. Leslie, receiver).
Oklahoma & Rich Mountain Railroad Company.
Oneida & Western Railroad Company.
Ontonagon Railroad Company.
Pacific and Idaho Northern Railway Company.
Pacific Coast Railroad Company (Washington).
Pacific Coast Railway Company (California).
Paris and Mt. Pleasant Railroad Co. (R. W. Wortham, receiver).
Pearl River Valley Railroad Company.
Pickens Railroad Company.
Pittsburgh & Susquehanna Railroad Company.
Port Huron and Detroit Railroad Company.
Prattsburgh Railway Corporation.
The Prescott and Northwestern Railroad Company.
Quakertown and Bethlehem Railroad Company.
Quanah, Acme & Pacific Railway Corporation.
Quincy Railroad Company.
Rahway Valley Company, Lessee.
Rapid City, Black Hills & Western Railroad Company.
Ray and Gila Valley Railroad Company.
Red River and Gulf Railroad.
The Rio Grande Eastern Railway Corporation.
Rockingham Railroad Company.
Rock Port, Langdon & Northern Railway Company.
Roscoe, Snyder and Pacific Railway Company.
Rowlesburg & Southern Railroad Company.
Sabine & Neches Valley Railway Company.
77 St. Louis and Hannibal Railroad Company.
Sandersville Railroad Company.
The San Luis Central Railroad Company.

The San Luis Valley Southern Railway Company.
Santa Fe Northwestern Ry. Co.
Santa Maria Valley Railroad Company.
Savannah and Atlanta Railway (Charles E. Gay, Jr., receiver).
Sheffield and Tionesta Railway Company.
Shreveport, Houston & Gulf Railroad Company.
Sierra Railway Company of California.
The Silverton Northern Railroad Company.
Skaneateles Railroad Company.
South Manchester Railroad Company.
The Stewartstown Railroad Company.
Sumter and Choctaw Railway Company.
Suncock Valley Railroad.
Susquehanna and New York Railroad Company.
Tabor and Northern Railway Company.
Talbotton Railroad Company.
Tallulah Falls Railway Company (J. F. Gray, receiver).
Tennessee & North Carolina Railway Company.
Tennessee, Kentucky & Northern Railroad Company.
Tennessee Railroad Company.
Texas, Oklahoma & Eastern Railroad Company.
Texas Southeastern Railroad Company.
Tionesta Valley Railway Company.
The Townsville Railroad Company.
Trinity Valley Southern Railroad Company.
Tuckaseegee and Southeastern Railway Company.
The Tuckerton Railroad Company.
Tucson, Cornelia and Gila Bend Railroad Company.
The Tuskegee Railroad Company.
78 The Uintah Railway Company.
Uvalde & Northern Railway Company.
Verde Tunnel and Smelter Railroad Company.
Virginia and Carolina Southern Railroad Company.
Virginia & Truckee Railway.
Virginia-Blue Ridge Railway.
Warren & Saline River Railroad Company.
Warrenton Rail Road Company.
The Washington, Brandywine and Point Lookout Railroad Company.
The Waterville Railway Company.
West Virginia Midland Railway Company.
West Virginia Northern Railroad Company.
White River Railroad Company (Vermont) (J. A. Cannon, receiver).
Wichita Falls & Southern Railroad Company.
Wichita Northwestern Railway Company (O. P. Byers, receiver).
Williamsport & North Branch Railway Co.
Wilmington, Brunswick & Southern Railroad Company.

Winchester & Wardenville Railroad Company (formerly Winchester & Western Railroad Company).
The Winfield Railroad Company.
Wisconsin & Michigan Railroad Company.
Woodstock Railway Company.
Wyandotte Southern Railroad Company.
Wyoming Railway Company.
Yadkin Railroad Company.
Yosemite Valley Railroad Company.

79 APPENDIX B

East Berlin Railroad Company.
East Erie Commercial Railroad.
Flemingsburg and Northern Railroad Company (passenger service).
Hanover Railway Company.
Marshall, Elysian Fields and Southeastern Railway Company.
Minnesota Northwestern Electric Railway Company.
Mount Jewett, Kinzua and Riterville Railroad Company (mail and passenger service).

80 *Exhibit C to petition*

Interstate Commerce Commission

(190 I.C.C. 351)

No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF BROTHERHOOD OF LOCOMOTIVE ENGINEERS, et al.

*v.*

ATLANTIC COAST LINE RAILROAD COMPANY ET AL.

Submitted October 6, 1932. Decided January 5, 1933

To promote the safety of employees and travelers upon railroads steam locomotives should be equipped with power-operated reverse gear. Appropriate rules approved and established.

H. N. McLaughlin, Oscar J. Horn, G. W. Laughlin, Thomas Stevenson, and Timothy Shea for complainants.

W. W. Ahrens, Sidney G. Alderman, B. F. Batts, W. S. Bronson, Ben B. Cain, Willis Crane, Fayette B. Dow, Harry P. Elkins, Thomas L. Ennis, Henry J. Hart, William J. Kane, W. J. Larabee, R. A. McCarran, Harry Z. Maxwell, Clarence A. Miller, Nye F. Morehouse, John W. Murphy, Robert E. Quirk, M. G. Roberts, William B. Rodman, J. R. Skillman, Dana T. Smith, Alfred P. Thom, Alfred P. Thom, Jr., D. W. Thomas, Arthur Van Meter, and Toll R. Ware for defendants.

A. R. McDonald for intervener.

Report of the Commission

Division 6, Commissioners Eastman, McManamy, and Lee

McMANAMY, *Commissioner:*

Exceptions were filed by complainants and defendants
81 to the report proposed by the examiner and the issues were argued orally.

By complaint filed by A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, it is alleged in substance that defendant carriers are using steam locomotives which are not in proper condition and safe to operate in the service to which the same are put, and which are not so equipped that they may be used without unnecessary peril to life or limb, in violation of the boiler inspection act, as amended. These conditions arise, it is alleged, because the locomotives are equipped with manually operated reverse gear instead of power-operated reverse gear. We are asked to require defendant carriers to equip their steam locomotives with reverse gear operated by power, or other devices adequate to protect (190 I.C.C. 352) the employees thereon from unnecessary peril to life or limb. The Railroad Commission of Wisconsin intervened in support of the complaint.

It will be understood that throughout this report we are dealing only with steam locomotives, as distinguished from locomotives propelled by power other than steam.

The boiler inspection act, as amended, provides, in part, that—
" it shall be unlawful for any carrier to use or permit to be used on its line any locomotive unless said locomotive, its boiler, tender, and all parts and appurtenances thereof are in proper condition and safe to operate in the service to which the same are put, that the same may be employed in the active service of such carrier without unnecessary peril to life or limb * * *."

The question of fact presented for determination is whether the use of locomotives equipped with hand reverse gear, as compared with power reverse gear, causes unnecessary peril to life or limb.

82 The valve gear of a steam locomotive consists of eccentrics or eccentric cranks, rods, links, rockers, etc., by means of which the valves which control the admission of steam into the cylinders are moved and their motion regulated. The valve gear is so arranged that direction of motion of the locomotive can be reversed as desired. It enables the engineer to work the locomotive at capacity by admitting steam into the cylinders during the whole or nearly the whole of the stroke of the pistons, or, when less power is required, to use the steam more economically by admitting steam into the cylinders during a portion of the stroke and working it expansively during the remainder of the stroke of the pistons. There are five types of valve gear in general use, i. e., Stephenson, Walschaert, Baker, Young, and Southern. It is not necessary for present purposes to

describe in detail the construction and operation of the various types of valve gear.

The reverse gear is the mechanism by means of which the valve gear is controlled and the direction of movement of a locomotive is reversed. The manually operated reverse lever is a lever pivoted to the frame, or the foot plate, and connected by means of a reach-rod and reversing arm to the link of the valve gear for moving the link, or link block, and thereby reversing the motion of the engine or regulating the admission of steam to the cylinders. On some locomotives the reach-rod is moved by means of a screw, with an operating wheel connected therewith.

The power reverse gear sought by complainants performs the same functions as the manually operated gear, but through the use of cylinders and rods the mechanism is moved by power, usually compressed air, instead of by hand.

(190 I.C.C. 353.) When locomotives are equipped with
83 hand reverse gear any derangement of the valve motion is communicated to the reverse lever in the cab through the lifting shaft and reach-rod. But when power reverse gear is used, the reach-rod terminates at the power reverse-gear cylinder, and the only connection to the cab is the rod connecting with the valve which admits air to the reverse-gear cylinder.

There are now reported to us a total of 60,522 steam locomotives which are subject to the Boiler Inspection Act, as amended. The record shows the kind of reverse gear on 57,541 of these locomotives. Of the latter, a total of 27,503 locomotives are equipped with power reverse gear and 30,038 locomotives are equipped with hand reverse gear. Applying this ratio to the 60,522 locomotives for which reports are being received, it may be said with reasonable accuracy that of the total locomotives subject to the Boiler Inspection Act, as amended, 28,925 are equipped with power reverse gear and 31,597 are equipped with hand reverse gear.

Certain of defendant carriers contend that we are without authority to require by an order of general application that locomotives be equipped with additional appliances, and also that if we have such power the procedure here followed is improper. A similar contention was considered and rejected in Wisconsin R. R. Commission *v.* A. & R. R. R. Co., 142 I.C.C. 199.

Our authority to specify the equipment to be used on locomotives has been repeatedly exercised and was considered and sustained by the Supreme Court in Napier *v.* Atlantic Coast Line, 272 U.S. 605. There the Court said:

"The question whether the Boiler Inspection Act confers upon the Interstate Commerce Commission power to specify the sort of equipment to be used on locomotives was left open in Vandalia R. R.
Co., *v.* Public Service Commission, 242 U.S. 255. We think
84 that power was conferred. The duty of the Commission is not merely to inspect. It is also to prescribe the rules and regulations by which fitness for service shall be determined."

The Court further said:

"If the protection now afforded by the Commission's rules is deemed inadequate, application for relief must be made to it. The Commission's power is ample."

The Supreme Court thus held that our power is ample to require for the promotion of safety, that additional equipment be installed on locomotives used in interstate commerce, and that "if the protection now afforded by the Commission's rules is deemed inadequate, application for relief must be made to it.' Obviously the Court was here referring to application for relief by the employees of the carriers or on behalf of the traveling public, because occasion would not arise for the carriers to apply to us in order to install additional equipment on their locomotives. This is made clear by consideration of the fact that the carriers have installed, without any application to or authority from us, various devices, including power reverse gear on 28,925 locomotives, or the very equipment which complainants contend should be applied on the remaining locomotives. The Court said that application for relief must be made to us. This has been done in this case, and we have followed our usual procedure in order to develop fully the facts upon which to base our judgment as to whether the prayer of complainants should be granted in whole or in part.

The carriers contend that our rules, approved and established under this act, can be changed only upon their application, and that the public, the employees, and the Commission itself are powerless otherwise. They urge that the only instance in which we have authority to require the installation of additional equipment is
85 when upon appeal from the decision and notice of an inspector, as provided in section 6 of the Boiler Inspection Act, that a particular locomotive does not conform to the requirements of the law and shall not thereafter be used because of the absence of the additional equipment we sustain such decision. We find no basis for such a view in the language of the Boiler Inspection Act or the decisions of the courts relating thereto. This contention can not be sustained.

On locomotives equipped with hand-operated reverse gear the engineer, or other person operating the locomotive, moves the reach-rod and other parts of the reverse gear, as well as the valve gear, by moving the reverse lever or wheel in the cab.

On locomotives equipped with power reverse gear the reach-rod is moved by power derived from an air cylinder and piston, or equivalent mechanism, the engineer merely moving the valve, which controls the flow of air, by means of a small lever or wheel in the cab.

Friction between certain parts of the reverse gear, and of the valve gear, and between parts of the valves and the steam chests, as well as the weight of the parts, whether or not counterbalanced, makes it necessary that considerable force be exerted in order to move the reverse gear. The force required is increased if there is steam in the steam chests and cylinders, and varies also with speed and with the

tractive effort being developed by the locomotive, and because of several other conditions which arise in practical operation. On a locomotive equipped with hand reverse gear, whatever force is necessary to move the reverse lever must be exerted by the person operating the locomotive. On a locomotive equipped with power reverse gear, the necessary force is exerted by air or steam pressure, the person operating the locomotive merely operating the valve which controls the flow of air or steam.

86 The cab of a locomotive is a shelter built of wood or sheet steel, usually enclosing the back end of the boiler, for the protection of the enginemen. On a relatively few locomotives having very wide fireboxes, two cabs are used; one for the engineer on the forward part of the boiler like a saddle; the other, much smaller, to shelter the fireman at the back end of the boiler. Many devices under the direct control of the enginemen are located on or near the boiler head and within the cab. The hand reverse lever, or reverse operating wheel, is one of such devices and is located at the right side of the cab near the engineer's seat. The reverse lever quadrant is a steel bar or bars forming an arc of a circle, over or along which the reverse lever moves. It is secured to the frame or deck plate or to the side of the boiler, and has notches cut in its upper surface for the reverse lever latch. The latch is intended to hold the reverse lever in any desired position along the quadrant. The distance between the reverse lever and other parts of the locomotive is herein termed reverse-lever clearance.

In the operation of locomotives many engineers, as well as others, have been injured by the hand reverse lever. Some accidents have occurred on locomotives equipped with power reverse which defendants urge would not have occurred if the locomotives involved had been equipped with hand reverse.

The evidence relating to accidents consists of testimony of witnesses who were injured or were on or around the locomotives when other persons were injured, and certain reports made by the carriers to us covering accidents on locomotives in which reverse gear was involved. The testimony of the witnesses was, in some instances, supplemented by reports covering investigation of accidents by our inspectors pursuant to the provisions of the Boiler Inspection Act.

87 While certain accidents are now attributed by defendants to the fact that the locomotives were equipped with power reverse gear, it is significant that in no case was the power reverse gear removed after the accident and hand reverse substituted. The locomotives involved, if in use, are still equipped with power reverse gear.

The record shows that during the 5-year period from 1925 to 1929, inclusive, there were 1,116 casualties due to reverse gear. The proportion of such casualties occurring on locomotives equipped with hand reverse gear is illustrated by the fact that of 232 cases occurring in 1929 and 1930 a total of 216 occurred on locomotives equipped

with hand reverse gear and 16 on locomotives equipped with power reverse gear. During the latter period there were about the same number of locomotives in service with power reverse gear as with hand reverse gear.

Many of the witnesses testifying on behalf of defendants were asked to express an opinion as to the relative merits of power and hand reverse gear from the viewpoint of safety. However, there is available evidence of the actual experience gained over a period of many years in the operation of thousands of locomotives having such equipment thereon.

The accidents which have occurred on locomotives equipped with hand reverse gear are attributable to several conditions. On many locomotives the hand lever is located behind the boiler head and at the side of the engineer's seat box. The clearance between the lever and the back board of the cab is frequently very small. In fact, on some locomotives the lever when in extreme backward position extends beyond the back board of the cab, which is cut out to permit the lever to pass. On other locomotives the clearance between the lever and the seat box, as well as between the lever and the
88 boiler head and appurtenances thereon, is very small. Many accidents have occurred, due to engineers and others being caught between the hand reverse lever and the other parts referred to, due to the small clearance. On most locomotives a stop-block or pin is provided near the ends of the quadrant for the purpose of limiting the travel of the reverse lever, so that it will not come in contact with the cab or the boiler and the appurtenances located thereon. If the stop-block is missing or, for any reason, fails to function, there is in most cases nothing to prevent the lever from coming in contact with the boiler or the cab, and numerous persons have been injured because this condition existed.

The space in which the engineer must work while operating the locomotive and while in his usual and proper position in the cab, in quite limited. This is especially true on the larger and modern locomotives. On such locomotives he is likely to be struck by the hand lever, if, for any reason, it suddenly moves. The fact that the hand reverse lever does suddenly move without warning to the engineer and from various causes, and that many injuries have resulted from such movements of the hand lever, is clearly established by the evidence. We do not deem it necessary for the purposes of this report to deal separately with various conditions which arise in actual operation and cause the hand lever in the cab to move suddenly and with force sufficient to cause injury if the person operating the locomotive is not able to avoid it.

Most of the accidents recorded as due to hand reverse gears occurred to employees while handling the reverse gear, whereas only a small percentage of the accidents attributed to power reverse gears occurred to men operating the reverse gear, the others having

occurred to persons on, around, or in the path of the moving locomotive.

89 Frequent reference is made in the record to the extent to which the injuries attributable to the hand reverse lever could be avoided if the engineer would be more careful as to where he places his arms and legs while operating a locomotive equipped with hand reverse gear. However, in actual operation and with the varied and frequent movements which the engineer is required to make in order to perform his duties properly, he can not constantly keep clear of the reverse gear in the cab. In theory this might be possible, but in actual practice it can not reasonably be expected. The engineer or other person operating the locomotive is as a matter of actual fact constantly subjected to whatever hazard exists in operating the hand reverse gear, and under many circumstances he has no way of effectively guarding against injury.

The operation of the reverse gear is affected by numerous conditions. Chief among these which are reported as causes for accidents referred to elsewhere in this report are the failures due to breakage of parts of the valves or the valve gear, lack of lubrication, the presence on parts of the reverse gear of frost, ice, or snow, and the presence of steam in the cylinders, which may be due either to leaking throttle valve or to leaking dry pipe, or to inoperative cylinder cocks or cylinder-cock operating rigging.

In actual operation the reverse gear must be moved frequently, the frequency varying with different classes of service. In switching service it is not uncommon for the reverse gear to be moved from 30 to 60 times an hour. In road service the movements are less frequent, but even in that service the reverse gear is moved several times each hour the locomotive is in use. The engineer is liable to be injured not only while making such adjustments but also on other occasions if the reverse gear moves suddenly and without being touched.

90 Defendant carriers urge that the equipment of locomotives with power reverse gear does not eliminate accidents and that the power reverse gear has not been applied with the thought of promoting safety. As explained by the carriers, the application of power reverse gear has been due to the increasing size of locomotives and because the limited clearance between the boiler and the side of the cab renders it impracticable to apply hand reverse gear. The carriers urge that in several respects power reverse gear is more hazardous than hand reverse gear.

In practically all, if not all, installations the power reverse gear is moved by compressed air. Frequently while locomotives are around terminals the air compressors are not in operation and no air pressure is available with which to operate the reverse gear. When there is no pressure in the operating mechanism of the power reverse gear, the weight of the valve gear causes the parts thereof to settle

or drop, so that if steam is admitted to the cylinders with the valve gear in this position the locomotive may move notwithstanding that the reverse gear operating lever in the cab is at the center of the quadrant. It will be understood that ordinarily when the operating lever in the cab is at the center of the quadrant, the valve gear is likewise in center position, and that steam would not be admitted to the cylinders so as to move the locomotive even though the steam throttle was opened. If the air compressors are started after the valve gear has settled, as referred to above, the valve gear will, as the air pressure increases, gradually assume a position corresponding to the position of the operating lever in the cab. Instances have occurred where the engineer in oiling around was caught, due to this unexpected movement of valve-gear parts. Other instances
91 have occurred where the operating lever in the cab was placed in a position which would ordinarily cause the locomotive to move in the desired direction, but due to the absence of air pressure the valve gear would not move to a corresponding position, thus causing the locomotive to move in the wrong direction. Injuries have resulted from this cause.

As previously explained, the power reverse gear ordinarily depends upon air pressure for its operation. Instances have occurred where by reason of a broken air pipe or from other similar causes air pressure on the reverse gear was lost. Under such circumstances the power reverse gear is inoperative unless steam can be admitted into the operating cylinder. Steam connections are provided on many locomotives equipped with power reverse gear so as to avoid the possibility of the reverse gear becoming inoperative when for any reason air pressure is not available. Such steam connections are seldom used, however, and are frequently not properly maintained so that they may be operated and serve their purpose when occasion arises. In one instance a collision resulted from the fact that no air pressure was available on the locomotive, thus rendering both the air brakes and reverse gear inoperative. In this instance a blind gasket was found in the steam line to the power reverse gear, which, of course, made it impossible for the engineer to admit steam into the reverse gear cylinder. In another similar instance the stem of the valve in the steam line to the power reverse gear was twisted off in an effort to open the valve, so that the steam connection could not be employed to serve the purpose for which it was installed.

In isolated instances, due to one cause or another, locomotives have unexpectedly moved when no air pressure was available with which to operate the air brakes. Under such circumstances it is
92 possible in some instances to stop the locomotive by reversing the engine and admitting steam to the cylinders. The carriers urge that this is a safety feature which may be employed with hand reverse gear but which is absent with power reverse gear, because air pressure is necessary to operate the power reverse gear just as it is

necessary to operate the air brakes. This argument is no more forceful against the use of power reverse gear than it would be against the use of power brakes.

Instances have occurred where serious injuries have resulted from employees being caught between some of the valve-gear parts and other parts of the locomotive when the power reverse gear was moved. The carriers urge that with manually operated reverse gear the presence of an obstruction, such as the arm or the head of a man, could be detected by the resistance offered to movement of the hand level or wheel, whereas with the power reverse gear this would not be detected.

Complainants urge that there is no liability of injury to the engineer in the cab due to action of the reverse gear on locomotives equipped with power reverse gear. They also contend that the power reverse gear promotes safety by making it possible for the engineer constantly to observe signals. In this connection it is said that with hand reverse gear it is necessary that the engineer bring his head and body inside of the cab in order to move the reverse gear, whereas with power reverse gear it is practicable for him to reverse the engine without losing sight of signals and men who may be working around the locomotive.

Defendants state that the average cost of equipping a locomotive with power reverse gear would be approximately $400, and that the power reverse gear is more expensive to maintain than hand reverse gear. Complainants urge that this expense would be offset by
93 increased efficiency obtained from the locomotive, due to faster operation being possible with power reverse gear than with hand reverse gear. Defendants urge, on the contrary, that due to what is generally termed "creeping" of the power reverse gear, it is less efficient than hand reverse gear. The term "creeping" refers to movement of the reversing mechanism as well as the valve gear without the operating lever in the cab having been adjusted, which causes an undesired change in the point at which the admission of steam into the cylinders is cut off. The thought is that the "creeping" makes it difficult to use steam in the most economical manner, *which results in unnecessary fuel consumption.*

Clearly the carriers of this country would not have equipped approximately 29,000 locomotives with power reverse gear, and would not contemplate so equipping practically all new locomotives, if such gears did not contribute to efficiency of locomotive operation, or if power reverse gear is less safe than hand reverse gear. The fault termed "creeping" causes no accidents and resolves itself largely into a question of proper maintenance. If the power reverse gears are properly maintained, we think "creeping" to any material extent will be eliminated. As to the ability to detect an obstruction in the valve gear, such as a man's head or arm, by the resistance offered to movement of the hand reverse gear, in time to avoid injury,

we do not think such a theory is sound. The matter of power reverse gears becoming inoperative while on the road, due to loss of air pressure, can be taken care of by properly applied and maintained steam connections. As to locomotives moving unexpectedly, and crashing through roundhouse walls or into turntable pits, it is common knowledge among railroad men that such movements are not confined to locomotives equipped with power reverse
94 gear but have also occurred on locomotives equipped with hand-operated reverse gear.

Several of the accidents and much of the trouble set forth in the record as occurring on locomotives equipped with power reverse gear occurred on locomotives equipped with what are now obsolete installations. The difficulties encountered on such locomotives cannot be reasonably expected with modern installations.

Counsel upon brief refer to our language in Public Utilities Commission of Ohio v. Pennsylvania R. Co., 151 I.C.C. 448, 464, with reference to the relative importance of serious or fatal injuries. The conclusions here reached in no way conflict with the principle there announced. Aside from the evidence of record we cannot believe that the carriers would contemplate the continued use of over 29,000 steam locomotives with power reverse gear, and contemplate the application of power reverse gear on new locomotives, if those in charge of the construction and operation of locomotives actually and sincerely believed that power reverse gear is less safe or less efficient than hand-operated reverse gear. Witnesses for the carriers, who were asked the question, were firm in their opinion that we should not require power reverse gear to be removed from present locomotives and hand-operated gears used in lieu thereof.

Defendants urge that the carriers generally are in such financial condition that they should not be required to make the expenditure necessary to apply power reverse gears.

As a practical matter we are, in the main, looking to the future in the consideration of this case. The rule established herein with respect to locomotives now owned by the carriers is that those having more than a specified weight on driving wheels be equipped with power reverse gear when they are shopped for class 3,
95 or heavier, repairs. Our last annual report shows that there were at that time 9,840 locomotives stored in serviceable condition and 6,442 others out of service undergoing or awaiting repairs. A large percentage of these locomotives is equipped with hand reverse gear. Whatever expense results from these applications will be distributed among a large number of carriers and spread over a period of approximately four years. A large number of the locomotives equipped with hand reverse gear are now set aside awaiting disposition and will never again be used. Many of the locomotives in service with hand reverse gear will be dismantled before they are again given class 3, or heavier, repairs.

The occurrence of accidents in actual operation of locomotives equipped with hand reverse gear is clearly shown of record. There is a further question before us as to the extent to which the use of any or all steam locomotives equipped with hand reverse gear causes unnecessary peril to life and limb, and whether the application of power reverse gear should be required on all locomotives at this time.

To draw a line of demarcation which will provide the degree of safety contemplated by the law and yet not cause unnecessary expense on the part of the carriers is not easy. While the accident records do not in all cases show the size of the locomotives on which accidents have occurred, they do indicate that the greater number occurred on the heavier types. This results from the difference in size and weight of parts which must be controlled and operated by the reverse gear, and from differences in speed and cab clearances and in other conditions encountered in the actual operation of locomotives. We cannot disregard the fact that thousands of the smaller types of locomotives are now in storage and will in all probability never again be used. Nor are we unmindful of the financial condition of the carriers, which was strongly urged as a reason for denial of the relief here sought. But we cannot believe the present financial condition will be permanent and we are convinced that action should now be initiated to afford relief in the future from the conditions complained of.

96

On the record in this case we conclude and find that the safety of employees and travelers on railroads requires that all steam locomotives built on or after April 1, 1933, be equipped with a suitable type of power-operated reverse gear.

We further find that all steam locomotives used in road service built prior to April 1, 1933, which weigh on driving wheels [1] 150,000 pounds or more, and all steam locomotives used in switching service built prior to April 1, 1933, which weigh on driving wheels 130,000 pounds or more, shall have such power-operated reverse gear applied the first time they are given repairs defined by the United States Railroad Administration as class 3,[2] or heavier, and that all such locomotives shall be so equipped before January 1, 1937.

We further find that air-operated power reverse gear should have a suitable steam connection so arranged and maintained that it can be quickly used in case of air failure.

An appropriate order amending our rules for the inspection and testing of steam locomotives and tenders and their appurtenances to give effect to these findings will be entered. (190 I.C.C.)

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[1] Weight on driving wheels means the weight of a locomotive in working order that is supported by the coupled wheels when it rests on a straight and level track, as defined in the Locomotive Cyclopedia.

[2] Class 3 repairs as defined by the United States Railroad Administration are as follows: "Flues all new or reset (superheater flues may be excepted); necessary repairs to firebox and boiler; tires turned or new; general repairs to machinery and tender."

97 ORDER

At a session of the Interstate Commerce Commission, division 6, held at its office in Washington, D.C., on the 5th day of January, A.D. 1933

No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF Locomotive Engineers, et al.

*v.*

ATLANTIC COAST LINE RAILROAD COMPANY, ET AL.

This case being at issue upon complaint and answers on file, and having been duly heard and submitted by the parties, and full investigation of the matters and things involved having been had, and the division having, on the date hereof, made and filed a report containing its findings of fact and conclusions thereon, which said report is hereby referred to and made a part hereof:

It is ordered, that rule no. 157 of the rules and instructions for the inspection and testing of steam locomotives and tenders approved and established in accordance with the act of February 17, 1911, as amended, be, and it is hereby, amended to read as follows:

157. Reverse gear.—Reverse gear, reverse levers, and quadrants shall be maintained in a safe and suitable condition for service. Reverse lever latch shall be so arranged that it can be easily disengaged, and provided with a spring which will keep it firmly seated in quadrant. Proper counterbalance shall be provided for the valve gear.

(a) All steam locomotives built on or after April 1, 1933, shall be equipped with a suitable type of power operated reverse gear.

98 (b) All steam locomotives used in road service built prior to April 1, 1933, which weigh on driving wheels [1] 150,000 pounds or more, and all steam locomotives used in switching service built prior to April 1, 1933, which weigh on driving wheels 130,000 pounds or more, shall have such power-operated reverse gear applied the first time they are given repairs defined by the United States Railroad Administration as class 3,[2] or heavier, and all such steam locomotives shall be so equipped before January 1, 1937.

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[1] Weight on driving wheels means the weight of a locomotive in working order that is supported by the coupled wheels when it rests on a straight and level track, as defined in the Locomotive Cyclopedia.

[2] Class 3 repairs as defined by the United States Railroad Administration are as follows: Flues all new or reset (superheater flues may be excepted); necessary repairs to firebox and boiler; tires turned or new; general repairs to machinery and tender.

(c) Air-operated power reverse gear shall have a suitable steam connection with the operating valves conveniently located in the cab of the locomotive and so arranged and maintained that in case of air failure steam may be quickly used to operate the reverse gear.

[SEAL] GEORGE B. McGINTY,
*Secretary.*

99 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Answer of United States of America*

Filed June 19, 1933

UNITED STATES, the above-named defendant, for answer to the petition filed herein against it says:

I

United States admits the truth of the allegations contained in paragraphs I, II, III, and IV of the petition, except that it disclaims knowledge of the alleged cost to petitioners of equipping their locomotives with power reverse gears as alleged in the first subdivision of said paragraph II, and alleges that said allegation, is incompetent, irrelevant, and immaterial, but that if it should become relevant on the trial of this case, United States will demand strict proof thereof; and except the statement contained in the last sentence of said paragraph II concerning the authority of the Interstate Commerce Commission under the Locomotive Boiler Inspection Act, to which the court is respectfully referred in its complete text for a full and accurate statement of the powers of the Interstate Commerce Commission thereunder.

II

Answering paragraph V, United States admits that the statements therein contained are approximately correct, but for a full, accurate, and complete statement of the matters therein mentioned, the court is respectfully referred to the report of said Commission, which is annexed as exhibit C to the petition.

100 III

Answering paragraph VI, United States admits that the statements therein concerning the allegations in the complaint filed before the aforesaid Commission are approximately correct, but for a full, complete and accurate statement of the allegations of said complaint the court is respectfully referred to the full text thereof, annexed as exhibit A to the petition.

IV

Answering paragraph VII, United States admits that the answer filed by the railroads to the complaint therein mentioned contained in substance the matters and things alleged in the several subdivisions of said paragraph VII.

V

United States admits the truth of the allegations contained in paragraph VIII of the petition.

VI

United States denies the truth of the allegations contained in paragraphs IX, X, XI, and XII of the petition, and denies that said order of the Commission is without authority of, or contrary to law, or void for the reasons set forth in said paragraphs, or for any other reason.

VII

Answering paragraph XIII, United States admits that the railroads filed with the Commission their petitions for reconsideration and reargument therein mentioned, and that the Commission denied said petitions, but United States denies that said order denying said petition constituted a refusal of opportunity to present evidence with respect to changed conditions subsequent to the closing of the record; denies that any such opportunity was asked for, and alleges that the only reference in said petitions to changed conditions subsequent to the closing of the record was therein represented as being within the informed knowledge of the Commission
101 or a matter of common knowledge; and United States further alleges that before denying said petitions the Commission gave full and due consideration thereto, and denies that the Commission's order denying said petitions was in any respect unlawful.

VIII

United States denies the truth of the allegations contained in paragraphs XIV, XV, XVI, and XVII of the petition, and particularly denies that enforcement of the Commission's said order of January 5, 1933, will deprive petitioners, or any of them, of their property without due process of law, and further denies particularly that enforcement of said order will result in irreparable or any other legal damage to petitioners, or any other parties respondent to said order.

IX

Further and affirmatively answering the allegations of the petition, United States alleges that in making and entering said order the said Commission acted fully within authority expressly conferred

upon it by statute, that it did not act unreasonably, arbitrarily, or otherwise in an unlawful manner; and alleges that said order anl the Commission's findings upon which it rests are fully supported by evidence properly of record, and that said order is lawful in all respects.

Except as herein expressly admitted, United States denies the truth of each and all of the allegations contained in the petition.

Wherefore, having fully answered the petition, United States prays that the relief therein prayed be denied and the petition dismissed with costs to the petitioners, and that it have the benefit of such other and further orders, decrees, or relief as may be just and proper.

Elmer B. Collins,
ELMER B. COLLINS,
*Special Assistant to the Attorney General.*

Wilfred J. Mahon,
WILFRED J. MAHON,
*United States Attorney.*

102 [*Duly sworn to by Elmer B. Collins, jurat omitted in printing.*]

103 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Intervention of Interstate Commerce Commission*

Filed June 13, 1933

To the honorable judges of said court:

In accordance with the provisions of section 212 of the Judicial Code, 36 Stat. 1150, I hereby enter the appearance of the Interstate Commerce Commission, as a party defendant, and of myself as its counsel, in the above-entitled suit.

DANIEL W. KNOWLTON.

104 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Answer of Interstate Commerce Commission*

Filed June 13, 1933

The Interstate Commerce Commission, intervening defendant in the above-entitled suit, hereinafter called the Commission, now and at all times hereafter saving and reserving to itself all and all manner of benefit and advantage of exception to the many errors and insuffi-

ciencies contained in the petition herein, for answer thereunto or unto so much or such parts thereof as it is advised that it is material for it to answer, answers and says:

I

Answering paragraph I of the petition, the Commission admits the truth of the allegations therein contained.

105

II

Answering paragraph II of the petition, the Commission admits the truth of the allegations therein contained, except those allegations which purport to state the provisions and requirements of the orders complained of and except those allegations which relate to the Commission's powers and duties under the Interstate Commerce Act and the Boiler Inspection Act. For correct information as to the requirements of said orders and the provisions of said acts, the Commission respectfully refers the court to the copies of said orders (shown in the petition at pages 12 to 17, inclusive, and 80 to 98, inclusive) and to the text of said acts.

III

Answering paragraphs III to XVII, inclusive, of the petition, the Commission admits and alleges that, in a proceeding then pending before it, namely, docket no. 24050, A. Johnston, grand chief engineer of Brotherhood of Locomotive Engineers et al. v. Atlantic Coast Line Railroad Company et al. (hereinafter called the Power Reverse Gear Case), it made and issued the report and order dated January 5, 1933, which is referred to in paragraph III and a copy whereof is attached to the petition, marked "Exhibit C", and that subsequently it made and issued in said proceeding the further and modifying orders of January 28, 1933, and March 18, 1933, which are set forth in paragraph VIII at page 13 of the petition; admits and alleges that said proceeding was instituted by the filing with the Commission of the complaint which is referred to in paragraphs III and VI and a copy whereof is attached to the petition,
106 marked "Exhibit A"; and admits and alleges that, following the filing of said complaint, the answers and supplemental answers which are referred to in paragraphs III, IV, and VII and copies whereof are attached to the petition, marked "Exhibit B", were filed on behalf of the defendant railroad companies.

Further answering said paragraphs III to XVII, inclusive, of the petition, the Commission admits and alleges that prior to the making and issuing of said report and orders, as aforesaid, it accorded to the parties to said proceeding, including the petitioners herein, full hearings; that at said hearings a large volume of testimony and other evidence bearing upon the matters covered by said report and orders

was submitted to the Commission for consideration, on behalf of said parties, including the petitioners, herein, by their respective counsel; that at said hearings questions relating to said matters were fully argued and submitted to the Commission for determination, on behalf of said parties by their respective counsel, whereupon the Commission determined said matters and made and entered said report and orders, which included the Commission's decisions, findings, conclusions, and orders in the premises; that upon the evidence before it, and as shown in and by said report and orders, the Commission made the findings and stated the conclusions upon which said orders are based.

The Commission further alleges that said findings and conclusions were and are, and that each of them was and is, fully supported and justified by the issues raised and the evidence before the Com-
107 mission in said proceeding; that in making said report and and orders, it considered and weighed carefully, in the light of its own knowledge and experience, each fact, circumstance, and condition called to its attention on behalf of the parties to said proceeding by their respective counsel, including all material matters covered by the allegations of the petition herein; that said orders were not made or entered by it either arbitrarily, or unjustly, or contrary to the relevant evidence, or without evidence to support them; that in making said orders the Commission did not exceed the authority which had been duly conferred upon it, or exercise that authority in an unreasonable manner; and the Commission denies each of and all the allegations to the contrary, contained in said bill of complaint.

Further answering paragraphs VIII and XIII of the petition, the Commission admits the filing of the petitions for reconsideration and reargument therein mentioned and that it entered the order therein set forth, denying said petitions. The Commission denies that said order was a refusal of opportunity to present evidence with respect to changed conditions since the closing of the record; denies that any such opportunity was asked for, and alleges that, on the contrary, the only reference in said petitions to changed conditions since the closing of the record was therein represented as being within the informed knowledge of the Commission or matter of common knowledge (petition for reargument by American Railway Association, page 12). The Commission further alleges that, before denying said petitions, it gave due and full consideration thereto; denies all allegations to the contrary; and denies that its
108 order denying said petitions was in any respect unlawful.

Further answering paragraph IX of the petition, the Commission denies that its report and orders complained of are without warrant or authority in law or that they are contrary to law for any of the reasons therein alleged or for any other reasons.

Further answering paragraph XV of the petition, the Commission denies each of and all of the allegations therein contained.

Further answering paragraphs XIV and XVI of the petition, the Commission denies that enforcement of its said orders would constitute a taking, or deprivation, of property of the railroads affected without due process of law in violation of the fifth amendment of the Constitution.

The Commission further denies that the petitioners or any of the railroads affected by its orders will suffer either irreparable injury or any other legal injury for the reasons set forth in the petition, or for any other reason, unless said orders of the Commission are restrained and suspended during the pendency of this suit.

Except as herein expressly admitted, the Commission denies the truth of each of and all the allegations contained in said petition, in so far as they conflict either with the allegations herein or with the statements or conclusions of fact included in said report and orders of the Commission, which are hereby referred to and made a part hereof.

All of which matters and things the Commission is ready to aver, maintain, and prove, as this Honorable Court shall direct, and hereby prays that said bill of complaint be dismissed.

INTERSTATE COMMERCE COMMISSION,
By DANIEL W. KNOWLTON,
*Chief Counsel.*

109 [*Duly sworn to by Frank McManamy, jurat omitted in printing.*]

110 In United States District Court

[Title omitted.]
[File endorsement omitted.]

*Petition of A. Johnston and D. B. Robertson for leave to intervene*

Filed June 16, 1933

Now come A. Johnston and D. B. Robertson, intervening petitioners herein, and respectively show as follows:

That said A. Johnston is the grand chief engineer of the Brotherhood of Locomotive Engineers, and the head and chief executive of said organization; that the Brotherhood of Locomotive Engineers is an organization, composed of about 67,000 locomotive engineers who are generally employed by the petitioning railroads, having as its principal purpose the improvement of working conditions and the promotion of the general welfare of locomotive engineers; that the said D. B. Robertson is president of the Brotherhood of Locomotive Firemen and Enginemen, and the head and chief executive of said organization; that the Brotherhood of Locomotive Firemen and Enginemen is an organization, composed of about 60,000 locomotive firemen and enginemen who are generally employed by the petition-

ing railroads, having for its principal purpose the improvement of working conditions and the promotion of the general welfare of firemen and enginemen; that the said A. Johnston and D. B. Robertson file this petition respectively on behalf of the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen, and also on behalf of a large number of locomotive engineers, firemen, and enginemen, whose names are to numerous to mention herein, and who are in the service of the petitioning railroad companies.

111 Said A. Johnston and D. B. Robertson, further show that, in such representative capacity, they are the complainants in docket 24050 before the Interstate Commerce Commission known as the power reverse gear case, in which case was entered the order which is sought to be enjoined and set aside in this cause.

Your petitioners further show that they file this petition for leave to intervene in the above entitled cause under and by virtue of the provisions of title, 28 U.S.C., section 45a and as of right.

Wherefore your petitioners pray that the court enter an order permitting them to intervene in the above entitled cause and making them parties thereto, with the right to file an answer within a time to be set by the court, to be represented by counsel, and generally to defend the above entitled cause, and for such other and further relief as may be proper in the premises.

HORN, WEISELL, MCLAUGHLIN & LYBARGER,
*1214 Engineers Bldg., Cleveland, Ohio,*
THOS. STEVENSON,
*1625 Guarantee Title Bldg., Cleveland, Ohio,*
*Attorneys for Petitioners A. Johnston and D. B. Robertson.*
HAROLD N. MCLAUGHLIN,
*Of Counsel*

[*Duly sworn to by A. Johnston, jurat omitted in printing.*]

112 NOTICE

Notice is hereby given that the foregoing petition of A. Johnston and D. B. Robertson for leave to intervene in the above entitled cause will come on for hearing before the Honorable S. H. West, district judge of said court, in his court room in the Federal Court Building in the city of Cleveland, Ohio, on the 16th day of June 1933 at 1:15 o'clock p.m., or whenever the court will hear the same

HORN, WEISELL, MCLAUGHLIN & LYBARGER,
THOS. STEVENSON,
*Attorneys for petitioners A. Johnston and D. B. Robertson.*

ACKNOWLEDGMENT

Service of the foregoing petition and a copy thereof is hereby acknowledged this 16th day of June 1933.

WILLIAM N. KING,
*Attorney for Petitioners.*

114 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order granting leave to intervene*

Filed June 19, 1933

On this 19th day of June 1933 the petition of A. Johnston and D. B. Robertson for leave to intervene in this cause came on to be heard, and the petition having been duly considered, and it appearing to the court that the said A. Johnston is the grand chief engineer of the Brotherhood of Locomotive Engineers, and the said D. B. Robertson is the president of the Brotherhood of Locomotive Firemen and Enginemen, and have filed said petition for intervention on behalf of the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen, and also on behalf of a large number of locomotive engineers, firemen, and enginemen, whose names are too numerous to mention herein, and who are in the service of the petitioning railroad companies; and it further appearing that the said A. Johnston and D. B. Robertson as aforesaid are the complainants in docket 24050 before the Interstate Commerce Commission, in which cause was entered the order which is sought to be enjoined and set aside in this cause.

It is hereby ordered by the court that the said A. Johnston and D. B. Robertson as aforesaid be and they are hereby granted leave to intervene in the above-entitled cause, and they are hereby made parties defendant herein; that leave is hereby granted said interveners to file an answer herein on or before the 19th day of June 1933; and to be represented by counsel, and generally to defend the above-entitled cause.

S. H. West,
*United States District Judge.*

115 In United States District Court

[Title endorsement omitted.]
[Title omitted.]

*Answer of A. Johnson and D. B. Robertson, interveners*

Filed June 19, 1933

Now come A. Johnston and D. B. Robertson, intervening defendants herein, and by leave of court first obtained file this their answer to the petition filed herein, and respectfully answer and say:

I

That said A. Johnston is the grand chief engineer of the Brotherhood of Locomotive Engineers, and the head and chief executive of said organization; that the Brotherhood of Locomotive Engineers is an organization, composed of about 67,000 locomotive engineers who are generally employed by the plaintiff railroads, having as its principal purpose the improvement of working conditions and the promotion of the general welfare of locomotive engineers; that the said D. B. Robertson is president of the Brotherhood of Locomotive Firemen and Enginemen, and the head and chief executive of said organization; that the Brotherhood of Locomotive Firemen and Enginemen is an organization composed of about 60,000 locomotive firemen and enginemen who are generally employed by the plaintiff railroads, having for its principal purpose the improvement of working conditions and the promotion of the general welfare of firemen and enginemen; that the said A. Johnston and D. B. Robertson
116 file this answer respectively on behalf of the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen, and also on behalf of a large number of locomotive engineers, firemen and enginemen, whose names are too numerous to mention herein, who are in the service of the petitioning railroad companies.

II

That the said A. Johnston and D. B. Robertson, in such representative capacity, are the complainants in docket 24050 before the Interstate Commerce Commission, known as the power reverse gear case, in which case was entered the order which is sought to be enjoined and set aside in this cause.

III

For further answer these intervening defendants adopt as their own, the same as if set forth at length herein, the answer filed herein by the Interstate Commerce Commission, intervening defendant.

Wherefore these intervening defendants pray that the bill of the petitioners herein be dismissed.

HORN, WEISELL, MCLAUGHLIN & LYVARGER,
*1214 Engineers Bldg., Cleveland, Ohio.*

THOS. STEVENSON,
*1625 Guarantee Title Bldg., Cleveland, Ohio,*
*Attorneys for A. Johnston and D. B. Robertson, Interveners.*

HAROLD N. MCLAUGHLIN,
*Of Counsel.*

[*Duly sworn to by A. Johnston, jurat omitted in printing.*]

119 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order setting cause for hearing*

Filed May 31, 1933

On this 31st day of May 1933 it appearing that the petitioners have this day filed their petition in the above-entitled proceeding seeking to have enjoined, suspended, annulled, and set aside a certain order of the Interstate Commerce Commission entered January 5, 1933, in a certain proceeding referred to as Interstate Commerce Commission docket no. 24050 (known as the "Power Reverse Gear Case"), as supplemented by certain subsequent orders, described in said petition, and praying for an interlocutory injunction and for an order temporarily staying, suspending, and enjoining the operation of said orders of the Interstate Commerce Commission; and

The said petition and application for such temporary stay, suspension, and restraining order and injunction having this day been presented to the court on behalf of said petitioners:

It is hereby ordered by the court that said application be, and it is hereby, set for hearing on Monday, June 19th, 1933, at 9:30 o'clock a.m. in the Federal Court Building, in the city of Cleveland, Ohio, and Honorable Smith Hickenlooper, United States circuit judge, sixth circuit, and Honorable Geo. P. Hahn, United States district judge for the northern district of Ohio, or such other
120 judge or judges as circumstances may require to be substituted for either or both of these judges, are called to the assistance of the judge of this court to hear and determine the said applications.

S. H. WEST, *District Judge.*

122 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order substituting judge filed June 8, 1933*

The application for interlocutory injunction having heretofore been presented to the undersigned district judge, who thereupon called to his assistance to hear and determine the same the Honorable Smith Hickenlooper, United States circuit judge, and the Honorable George P. Hahn, United States district judge for said district, and it now appearing that Judge Hahn will not be available for such service,

It is hereby ordered that the Honorable John M. Killits, United States district judge for the northern district of Ohio be substituted in the place and stead of the Honorable George P. Hahn, to assist in hearing and determining said application at the time and place heretofore fixed.

S. H. WEST, *District Judge.*

123 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Stipulation as to elimination of exhibits 26 and 27*

Filed May 31, 1933

It is hereby stipulated by and between counsel for the petitioners and counsel for defendant United States of America that in preparing, for introduction in evidence in this court upon the trial of the above-entitled cause, a copy of the transcript of testimony and exhibits introduced before the Interstate Commerce Commission in its proceeding entitled docket no. 24050, Johnston *v.* Atlantic Coast Line R. Co. et al., 190 I.C.C. 351, exhibits nos. 26 and 27, which consist of two composition C rings may be omitted; that said original exhibits cannot be reproduced by copying or photographing, and are not deemed by counsel for petitioners and counsel for the United States to be essential to the consideration and decision of this cause by this court.

MAY 31, 1933.

WILLIAM N. KING,
SIDNEY S. ALDERMAN,
H. Z. MAXWELL,
ALFRED P. THOM, Jr.,
NYE F. MOREHOUSE,
*Counsel for Petitioners.*
Elmer B. Collins
ELMER B. COLLINS,
*Special Assistant to the Attorney General,*
*Counsel for United States.*

125 In United States District Court

[File endorsement omitted.]
[Title omitted.]

Present: Honorable Smith Hickenlooper, United States circuit judge; Honorable S. H. West, and Honorable John M. Killits, United States district judges.

*Journal entry of argument and submission*

Filed June 19, 1933

This day came the parties by their respective counsel and this cause came on to be heard upon the petition for a temporary restraining order filed by the plaintiffs herein and thereupon, by agreement of the parties, it was stipulated that the hearing on the petition for a temporary restraining order be considered as a final hearing upon the merits.

Thereupon the hearing proceeded and the court having heard the opening statements of counsel, the testimony adduced on behalf of the plaintiffs, no testimony having been adduced on behalf of the defendant or intervening petitioners, and the court, having heard the arguments of counsel, thereupon took the cause under advisement upon briefs to be filed by the parties within ten (10) days.

S. H. WEST,
*United States District Judge.*

126 *Plaintiff's exhibit no. 2*

I, George B. McGinty, secretary of the Interstate Commerce Commission, do hereby certify that the attached is true copy of exceptions of complainants to the report proposed by John L. Rogers, examiner, filed April 14, 1932, in docket no. 24050, A. Johnston, grand chief engineer of Brotherhood of Locomotive Engineers, et al. *v.* Atlantic Coast Line Railroad Company et al., the original of which is now on file and of record in the office of this Commission.

In witness whereof I have hereunto set my hand and affixed the seal of said Commission this 15th day of June, A.D. 1933.

[SEAL] GEORGE B. MCGINTY,
*Secretary of the Interstate Commerce Commission.*

129 Before the Interstate Commerce Commission

Docket No. 24,050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF Locomotive Engineers and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE RAILROAD COMPANY ET AL., DEFENDANTS

EXCEPTIONS OF COMPLAINANTS TO THE REPORT PROPOSED BY JOHN L. ROGERS, EXAMINER

Now come A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, president of the

Brotherhood of Locomotive Firemen and Enginemen, complainants herein, and, while concurring in and supporting the report proposed herein by John L. Rogers, examiner, in its principal findings and conclusions, nevertheless respectfully except to the following particulars of said proposed report:

1. To the exemption, from the recommended rule requiring power reverse, of steam locomotives used in road service having a weight of less than 150,000 pounds on driving wheels, and of steam locomotives used in yard service having a weight of less than 130,000 pounds on driving wheels.

130 2. To the following finding and conclusion of the examiner (sheet 50):

"We likewise are of the opinion that complainants are unsound in their reasoning that all steam locomotives should in the interest of safety be equipped with power reverse gear. The latter contention ignores differences in size of locomotives and parts thereof, differences in speed, cab clearances, and in other conditions encountered in actual operation."

BRIEF

It is the contention of complainants that all steam locomotives used by the carriers subject to the jurisdiction of the Commission should be equipped with power reverse gear. In the proposed report the examiner has ably described the hazards attendant upon the use of manual reverse. His conclusions, both upon mechanical matters and the record of accidents, as contained in the proposed report, are the sound basis of a rule requiring power reverse on the larger engines, but are likewise just as applicable to the smaller locomotives which he recommends be exempt from the application of the proposed rule. The learned examiner himself must appreciate the logic of an all-inclusive rule when he says (sheet 50): "To draw a line of demarcation which will provide the degree of safety contemplated by the law and yet not cause unnecessary expense on the part of the carriers is not easy."

In determining the proposed exemption, the examiner suggests that differences in the size and speed of locomotives and in cab clearances and other operating conditions render the installation of power reverse unnecessary on the smaller locomotives. To the extent

131 that such differences exist we submit they are of little significance because of other factors which peculiarly affect the situation as to light locomotives. The record indicates that most of the locomotives within the exempted weights are equipped with Stephenson link motion and slide valves. This type of motion is heavier than any other, and with it the engineer, in handling the reverse lever, must lift the weight of the heavy links and the four heavy eccentric blades. Moreover, the slide valves with which these locomotives are equipped create more friction than the piston valves

of the more modern engines, and are consequently more difficult to move. In fact the testimony of both complainants' and defendants' witnesses is that the older and lighter locomotives which are exempt from the examiner's proposed order are often as hard or harder to handle than the newer and larger locomotives. The following references to the record amply sustain this conclusion:

COMPLAINANTS' WITNESSES

Hunt, D. & H. Sometimes 130,000-pound engines are much harder to reverse than one of the larger ones (R. 145).

Greenwood, D. & H. Has found manual gear on 125,000- to 130,000-pound engines just as hard to operate as on the heavy type engines. Lots of times has to have the assistance of the brakeman and fireman when engines are new out of shop, with the small engine as well as the large engine (R. 188).

Diller, Penna. On the small class R engines manual reverse operated just about the same as on the larger engines (R. 255 B).

Ginder, Erie. Not very much difference in the handling of ten-wheel engines weighing around 90,000 to 100,000 pounds, and the larger engines weighing 154,000 pounds and upwards (R. 298).

132 Tanner, B. & M. Considers 4–4–0 engines weighing around 100,000 pounds practically as hard to handle as the heavier power, basing his answer on the fact that the former have Stephenson motion and slide valves, while the heavier engines have Walschaert motion and piston valves (R. 359).

Brown, N. Y. C. Ten-wheel engines used in local freight weighing between 80,000 to 100,000 pounds all handle hard enough, and there is always the danger of getting your fingers or feet caught, you always have to look out for the danger of getting hurt on them (R. 386).

Haire, Michigan Central. The performance of the manual lever on ten-wheel freight locomotives weighing 112,000 to 140,000 pounds equipped with Stephenson link motion and slide valves is practically the same as it is on any of the rest of the manually operated reverse levers. Under certain conditions it is liable to jump out of the quadrant and it is very hard to hook up from the forward corner to the center while running. When putting the lever from center toward the back corner it is comparatively hard to handle, and witness has had to get off his seat and throw his weight on the lever to force it into back motion (R. 476).

Austin, Savannah and Atlanta. 105,000-pound engines sometimes handle hard, and when they do he has to brace himself as on other engines. While handling the lever it will jerk at times, and he sometimes has to have the assistance of the fireman to take slack (R. 600). On the 80,000-pound engines the lever was so hard to handle that sometimes he would leave it in working position when he ordinarily wanted to drop it down (R. 609).

Larsen, C. & N. W. Smaller engines with Stephenson motion and slide valves handle as hard as the bigger power with Walschaert motion and piston valves (R. 740).

Rogers, C. B. & Q. Ten-wheel engines weighing 92,900 pounds to 100,700 pounds equipped with Stephenson motion and slide valves handle harder than 151,000-pound engines equipped with piston valves. A Stephenson motion engine will handle harder than a Walschaert motion engine of the same weight due to the fact that
133 with the former it is necessary to raise or lower the links which are heavier parts than the link block which is moved in the Walschaert gear (R. 887–9).

Kinnaird, L. & N. Handling the manual lever on a 4–4–0 engine with Stephenson motion and slide valves weighing 80,000 pounds (R. 968) is not much different than handling the lever on a Pacific type of engine. Witness has had the lever jump out of the quadrant and pull away from him while handling it on such 4–4–0 engines (R. 973).

DEFENDANTS' WITNESSES

Lindquist, C. & N. W. Has had some small locomotives that were harder to handle than some of the larges ones (R. 2381).

Jenness, road foreman of engines, Penna. Slide valves handle harder than piston valves (R. 3286).

Lashbaugh, U. P. The difference in handling the small Standard engine with slide valves and his present 163,000-pound engine with piston valves is not noticeable, and one is practically as hard to work as the other (R. 2715).

Murphy, road foreman of engines, N. P. 100,000-pound engines equipped with slide valves handled harder with manual reverse than the piston valves on a 150,000-pound engine, and witness had more trouble with valves jerking on the old type of slide valves with lighter power than he had with the heavier type with piston valves (R. 2979).

Love, N. P. Standard engines weighing about 60,000 pounds with slide valves handle practically the same as the larger locomotives he now has equipped with piston valves (R. 3045).

Slosson, N. P. Has had more difficulty in handling the lever on 80,000-pound slide valve engines than on the larger piston valve engines (R. 3089–90).

Rowe, G. N. Slide valves require more strength to handle than piston valves, especially if the valve is scratched or cut or you break a strip spring (R. 3180).

134 Canady, A. T. and S. F. Has not seen much difference between reversing small locomotives and large ones (R. 5174).

As far as weight on drivers is concerned, ranking officials of the carriers themselves testified that this factor has little significance as to the ease of handling manual reverse gears. Witness Cart-

wright, assistant mechanical engineer of the New Haven Road, testified that the purport of his testimony was that the weight on drivers is not a factor that influences the power required to handle the reverse gear (R. 5875); that the power required on the large engine, using the term to cover weight on drivers, is not much greater than on the small engines, that is, within the range of a few pounds (R. 5876); that he himself has handled the manual reverse levers on almost every different class of engine which his road has, during work he had to do in testing locomotives, and he could not see any material difference in the force required between, for instance, locomotives weighing about 154,000 pounds and ones weighing about 80,000 pounds on drivers (R. 5877).

J. W. Burnett, assistant general superintendent of motive power of the Union Pacific, testified (R. 4991) that the size of a locomotive has very little, if anything, to do with the labor in reversing an engine with a hand reverse gear, and that the modern valve motion in fact reverses them much easier than the old type engine with the Stephenson link motion.

As to differences in the speed with which the so-called small engines are operated in comparison with the larger ones, the testimony of Assistant Superintendent of Motive Power Bjorkholm, of the Milwaukee, will be recalled. He testified (R. 5407) that the valves of the locomotive move reciprocally at a very rapid speed, and as the speed increases the number of times that the valves must be reversed likewise increases, and that consequently the strain imparted from the valve motion to the reverse gear is increased. That strain, however, he further testified, does not go in proportion to miles per hour but rather in proportion to piston speed, so that a low-wheeled engine which does not make the same miles per hour as a larger and more modern engine might nevertheless have the same piston speed. When it is considered that many of the older type locomotives included within the exemption are doubtless low-wheeled locomotives it will be seen that their rapid piston speed will bring about the same strain and consequent pull on the manual reverse bar as exists on the larger locomotives.

Moreover, the digest of manual reverse accidents suffered by the complainants' witnesses included in the proposed report contains ample evidence to show that all locomotives, of whatever size, should be equipped with power reverse. As we analyze the 40 cases cited by the Examiner, on sheets 12 to 16, both inclusive, 15 of them occurred on locomotives of a weight probably falling within the proposed exemption. (Cases numbered 1, 15, 16, 17, 19, 20, 21, 23, 30, 33, 34, 36, 37, 38, 39.) We may say that the weight of some of the locomotives involved in these 15 accidents was not testified to with exactness, and a weight was given which might throw them either within or without the exempted classes. In the great majority of these 15 cases, however, it clearly appeared that the locomotives involved were of a size which would bring them within the exemption. A full

statement of the weights on drivers of the locomotives upon which complainants' witnesses were injured was given in com-
136 plainants' brief, pages 130 to 131, and is here repeated for the convenience of the Commission.

The bold face type indicates injuries sustained on locomotives weighing less than 150,000 pounds on drivers.

| Name | Injury | Weight on drivers of locomotive | Page reference |
|---|---|---|---|
| **Stone** | **Bruised heel** | **140, 000–170, 000** | **R. 69** |
| Hunt | Torn ligaments in back | 200, 000 | R. 141 |
| Greenwood | Ruptured | 165, 000–175, 000 | R. 178 |
| Stuckey | Ruptured | 220, 000 | R. 204, 198 |
| Irwin | Ruptured | Not given | R. 225 |
| Speas | Broken wrist | 170, 000 | R. 241 |
| Diller | Rib and ligament torn lose | Not given | R. 254 |
| Hurd | Scalded | Not given | R. 281 |
| Ginder | Strained hip | 238, 000 | R. 298 |
| Lawrence | Broken wrist | 176, 000 | R. 328 |
| Tanner | Broken leg | 170, 000–200, 000 | R. 360 |
| Brown | Broken arm | 186, 000 | R. 386 |
| Flood | Ruptured | 170, 000–200, 000 | R. 410 |
| Snoddy | Broken leg | 200, 000–246, 000 | R. 442 |
| Southard | Two ribs fractured | 17, 000–200, 000 | R. 493 |
| **Price** | **Ruptured** | **115, 000** | **R. 513** |
| **Pearce** | **Mashed finger** | **104, 800** | **R. 530** |
| **Stakeman** | **Broken leg** | **101, 500** | **R. 542,544** |
| **Small** | **Broken leg and multiple fracture of knee** | **145, 000** | **R. 561** |
| Howard | Bruised hand | 218, 740 | R. 577 |
| **Austin** | **Sprained wrist** | **110, 000–112, 000** | **R. 604,606** |
| Williams | Sprained wrist and bruised bone | 200, 000 | R. 645 |
| " | Ruptured | 200, 000 | R. 648 |
| **Domini** | **Ruptured** | **140, 000** | **R. 677** |
| " | **Sprained back** | **100, 000** | **R. 679** |
| **Rudolph** | **Wrenched back** | **140, 000–170, 000** | **R. 702** |
| " | **Bruised foot** | **100, 000–150, 000** | **R. 704** |
| Larsen | Ruptured | Not given | R. 741 |
| 137 **Stringer** | **Bruised two toes** | **100, 000–150, 000** | **R. 758** |
| Rasmussen | Strained back | 154, 000–174, 000 | R. 766 |
| Adams | Broken and cut foot | 150, 000 | R. 792 |
| Underwood | Temporary paralysis of vocal cords | 158, 000 | R. 822 |
| Garman | Finger broken and mashed | 168, 000 | R. 844 |
| Crum | Bruised right breast | 205, 800 | R. 865,857 |
| Rogers | Strained hip | Not given | R. 889 |
| **Inglett** | **Muscles strained in arm and shoulder** | **123, 000** | **R. 904** |
| Barton | Muscles strained in back | 207, 000 | R. 919 |
| Lowe | Both arms broken, leg broke and dislocated shoulder. | 180, 000–200, 000 | R. 943 |
| **Kinnaird** | **Muscles and ligaments pulled from pelvic bone.** | **140, 000** | **R. 973** |
| **Paschall** | **Rupture** | **140, 000** | **R. 998** |
| Gans | Torn ligaments in knee | 172, 000 | R. 1017 |
| **Dixon** | **Rupture** | **140, 000–170, 000** | **R. 1035** |
| **Pool** | **Fractured knee** | **137, 000** | **R. 1060** |
| " | **Rupture** | **140, 000** | **R. 1062** |
| **Walker** | **Rupture** | **127, 000** | **R. 1102** |
| **Young** | **Blood clot on knee** | **112, 000** | **R. 1121** |
| Brandt | Cut knuckles | 166, 000 | R. 1140 |
| Calame | Broken leg | 156, 000 | R. 6446 |

As appears from the examiner's summary, on sheets 12 to 16, some of the most severe injuries caused by manual reverse occurred on road locomotives weighing less than 150,000 pounds on drivers, and on yard locomotives weighing less than 130,000 pounds on drivers.

Case no. 16, on sheet 13 of the examiner's summary, involved Engineer Stakeman, a man 73 years old, who at the time was running an Atlantic type engine in passenger service weighing 101,500 pounds on drivers. He started to hook up his engine and
138 braced himself with his foot against the boiler head and when he raised the latch the lever took him to the corner and broke his leg, catching it against the air pipes which come down from the

brake valve. He was injured on January 31, 1931, and had not yet been able to return to service up to the date of the hearing, May 14, 1931 (R. 544, 542).

Case no. 17, on sheet 14 of the examiner's summary, involved Engineer Small, a man 70 years of age at the time of injury, who was running a ten-wheel engine weighing 145,000 pounds on drivers in passenger service. At a speed of 55 to 60 miles per hour the main driving journal broke and came up and struck the reach rod, throwing the reverse lever into back gear and catching the engineer's leg against the back board. When this breakage occurred the reverse lever went back and forth over the quadrant many times, hitting him every time. His left leg was broken above the knee, and he sustained multiple fractures at the knee joint. As a result he was laid up six weeks in splints, ten weeks in a cast, and had to have his knee massaged and baked for ninety days. He has not been able to do any work since that time (R. 561).

Case no. 37, on sheet 15 of the examiner's summary, involved Engineer Pool, a man 55 years of age at the time of the accident, who was runing an engine weighing 137,000 pounds on drivers in freight service. At a speed of 15 to 18 miles per hour the front hanger to the right front driving spring broke and the spring fell with one end under the eccentric blade of the Stephenson motion engine which caused the reverse lever to fly out of the quadrant and come back so quickly that he could not see it. The lever grazed his head, cut his glasses off, skimmed his face and ear, and cut his knee cap open in two places and went into the socket of the knee. He
139 underwent an operation to the knee, having his leg in a cast for six weeks, and being off duty three months. When he testified, three years after the accident, he still had a stiff leg. (R. 1060.)

Case no. 38, on sheet 16 of the examiner's summary, involved Engineer Walker, a man 37 years of age at the time of the accident, who was running an engine in switching service equipped with Stephenson valve motion and slide valves weighing 127,000 pounds on drivers. The driving wheel spring equalizer post broke permitting the spring to drop on the eccentric straps and cause the reverse lever to unlatch and fly back from forward toward backward motion without any warning whatsoever, striking him in the left side, causing a hernia. He underwent an operation, and was off duty for 91 days (R. 1102).

No analysis by weights on drivers can be made of the 216 manual reverse casualties taken from complainants' exhibit 13 which the examiner summarizes on sheets 16 to 30, both inclusive, for the reason that the weight of the locomotives in question was not disclosed in the report of these casualties to the Bureau of Statistics. If the proportion between heavy and light engines shown with reference to the above mentioned 40 cases is followed, about 80 of the 216 casualties presumably occurred on locomotives of the exempted sizes. At any rate it may be safely said that a substantial number of such casualties do happen on light locomotives.

We submit that upon the evidence the conclusion must be reached that light locomotives should be included within the rule requiring power reverse as well as the heavier ones.

It may well be that the examiner determined upon the pro-
140 posed exemption of light engines out of consideration of the expense involved in the installation of power reverse. As he very soundly points out, however (sheet 47), "the question of financial ability to apply the requested equipment cannot, as a matter of law, properly have any bearing upon the decision of the Commission in this case." If the Commission desires to extend any leniency to the carriers in view of the expense of equipping all locomotives, we suggest that the installation can be spread over a four- or five-year period and as the locomotives receive class 3 or heavier repairs, in the manner recommended by the examiner. Such a provision would obviate the necessity of taking the locomotives out of service to apply the gear, and reduce the cost of installation, since the application could be made while the locomotive is undergoing heavy repairs. Likewise its effect would be to spread expenditure over a considerable period of time.

The principal objection which defendants can make to equipping the older and lighter locomotives which the examiner exempts is that most of such locomotives will soon be obsolete, and the expense of equipping them would not be justifiable. The answer to this contention is that undoubtedly most of such locomotives will be scrapped within a four- or five-year period, and before the suggested order as to them would become finally effective. If such locomotives are worth class 3 repairs, or are valuable enough to be kept in service after such period has expired, they are certainly valuable enough to warrant the small expense of installing power reverse. On the other hand if they are not worth this expenditure, it is submitted that, in the interest of safety, they are not fit for use, and that upon the expira-
tion of the time limit should not be used. The dangers attend-
141 ant upon using worn-out locomotives which are given only stinted repairs because they are nearly obsolete should be apparent to everyone.

We submit that the examiner erred in drawing a line of demarcation—which was apparently influenced by his desire to "not cause unnecessary expense on the part of the carriers"—both because the evidence does not warrant any exemptions in view of the requirements of safety, and because the matter of expense is immaterial and inconsequential.

The Commission, we are sure, appreciates its responsibility in preventing such accidents as occurred to witnesses Stakeman, Small, Pool, and Walker, cited above, which occurred on road or yard locomotives of a weight exempted by the examiner's proposed report. In the interest of protecting the thousands of locomotive engineers and firemen represented by these complainants we submit that not only should the proposed report of Examiner Rogers be approved insofar as power reverse be required by rule of the Commission upon all

locomotives of the weights designated in said report, but that the Commission should extend the provisions of such rule to all steam locomotives under its jurisdiction.

Respectfully submitted.

OSCAR J. HORN,
THOS. STEVENSON,
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HAROLD N. McLAUGHLIN,
*Of Counsel.*

CLEVELAND, OHIO, *April 11, 1932.*

142 [File endorsement omitted.]

*Plaintiff's exhibit no. 3*

I, George B. McGinty, Secretary of the Interstate Commerce Commission, do hereby certify that the attached is true copy of exceptions to proposed report and brief on behalf of respondents represented by the American Railway Association, filed April 15, 1932, in docket no. 24050, A. Johnston, grand chief engineer of Brotherhood of Locomotive Engineers, et al. v. Atlantic Coast Line Railroad Company et al., the original of which is now on file and of record in the office of this Commission.

In witness whereof I have hereunto set my hand and affixed the seal of said Commission this 15th day of June, A.D. 1933.

[SEAL] GEORGE B. McGINTY,
*Secretary of the Interstate Commerce Commission.*

143–147 [Caption and index omitted.]

148 Before the Interstate Commerce Commission

Docket no. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE R. R. CO., ET AL., RESPONDENTS

EXCEPTIONS TO PROPOSED REPORT AND BRIEF ON BEHALF OF RESPONDENTS REPRESENTED BY THE AMERICAN RAILWAY ASSOCIATION

443 railroads, respondents in this proceeding appearing by and through the American Railway Association (3-12, 15),[1] file these

[1] The figures in parentheses indicate inclusive pages of the record; when the abbreviation Abst. is used, these page references refer to the Abstract filed by these defendants; when the abbreviation Br. is used, it refers to the brief heretofore filed by these respondents. The terms "respondents" and "defendants" used herein mean the 443 above referred to.

exceptions to the report proposed herein by Examiner John L. Rogers, for adoption by the Commission. These exceptions are of three classes, viz: (1) Exceptions to the proposed statements of the facts and issues and proposed conclusions based thereon, (2) exceptions to the proposed statement and conclusion that the financial condition and ability of the defendants cannot be considered by the Commission and (3) exceptions to proposed conclusions of law as to jurisdiction of the Commission.

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## I

### Exceptions to the proposed statements of facts and issues and proposed conclusions based thereon

In certain respects the proposed report herein fails to either accurately or fully state the facts shown of record. Neither is the issue fully stated. In some instances, evidence is not mentioned which is necessary to a complete and accurate statement and understanding of the case. In other instances important and relevant evidence is disregarded—evidence which has a vital and controlling bearing upon the issues. The evidence to which we shall refer in these exceptions is, practically without exception, wholly uncontradicted, and, as these defendants view the matter, cannot either in law or in justice be, by the Commission, left out of its consideration of this case. Numerous exceptions become necessary to correct these errors in the proposed report, which must be corrected to enable the Commission to write a report in this case which will fairly summarize the relevant evidence as a whole, state the only conclusions therefrom which such evidence warrants, and thus enable the Commission to reach a just, an informed, and an intelligent decision based upon these facts and conclusions.

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Assuming, but not admitting the Commission's jurisdiction, and in furtherance of the ends just stated, we take the following exceptions:

### Description of hand reverse gears

1. Respondents except to the paragraph beginning near the bottom of sheet 2 and extending to the end of the eighth line on sheet 3, because the same is not sufficiently comprehensive to permit of a clear understanding of the evidence and issues and omits certain important facts with respect to manually operated reverse gears. The following paragraphs should be inserted after line 8:

"The manually operated reverse gear of the lever type or 'Johnson bar', as it is often referred to, to which the evidence in this case principally refers, consists of nine parts. We have a bar with a rod attached and a means of securing the bar at any desired point of adjustment in the quadrant. In order to transmit the movement and adjustment of the lever to the locomotive valves, one of which

is located on each side of the locomotive, a so-called tumbling shaft is installed which is nothing more or less than a shaft extending crosswise of the locomotive underneath the boiler and securely held in place by two bearings, one on each side, attached to the locomotive frame, being fitted up with bushings, and lubrication provided for so that it may be easily revolved backward or forward. Rigid arms extend out from this tumbling shaft, and to one of these the forward end of the reach rod is attached. Likewise attached to
151 similar arms, one on either side of the locomotive, are thrust rods which extend forward, connecting with the valve gear on either side through which the aforesaid movement and adjustment of the valves is accomplished. Means of lubrication is provided for all bearing surfaces. In order to counterbalance the weight of such parts of the valve gear as have to be moved in making adjustments of the lever, there is provided a counterbalance spring (or springs) which is attached to another arm of the tumbling shaft and can be adjusted to such degree of compression as may be necessary to equalize the aforesaid weight. Take for example an engine equipped with Stephenson valve gear, in which the links themselves have to be raised and lowered in the adjustment of the lever, sufficient tension is put in this counterbalance spring to carry or equalize the weight of the links so that one can pull the lever to the center of the quadrant with no effort to speak of. As you throw the lever forward, dropping the weight of the links, this compresses the spring. With Walscheart valve motion, when the lever is moved, instead of moving the links, you simply move a small block (called the 'link-block') which slides up and down in the link, and you raise or lower the rear end of the radius rod (that being the rod which is attached to and extends forward from the link-block and connects with the valve stem) (889). But regardless of the kind of valve motion, every reverse gear has a counterbalance spring on it which is designated and constructed to balance the weights of the parts that are moved, and reduce the force that is required to be exerted on the reverse lever and transmitted through the reach rod in order to move the valves (47–49, 5868–5870, 623–4).

152 "These counterbalance springs are adjustable so that the amount of pressure exerted by them may be increased or decreased by tightening or loosening a nut, and thus the action of the lever may be readily adjusted by the use of a wrench. This adjustment may be easily made at any time the locomotive is standing still, either by the engineer or fireman while the engine is out on the road, or by roundhouse or mechanical forces at terminals, and in any event is a matter of but a few minutes' work with a wrench (623–4, 1165–7, 1892).

"Thus it will be seen that the amount of force required to operate the reverse gear has no relation to the weight or size of the locomotive (4991–2, 5875–7). It depends in the first instance upon the type, size, and weight of the locomotive valves and valve gear, but in the final analysis depends almost entirely upon the counterbalanc-

ing arrangements and the adjustment thereof (623–4, 3088–90, 1165–7). The difference in steam pressure carried on the different locomoties makes no difference with the modern type of balanced valves in use. The trend in design of valve gear parts in recent years has been to make them lighter in weight and in general the valve gear parts are no heavier on the medium weight and larger types of locomotives than on the smaller and more obsolete types (5855–70, 4991–2).

"Numerous engineers, witnesses on both sides alike, testified that in actual operation of locomotives there is no substantial difference in the amount of strength required on large and on small engines, in the handling of manually operated reversing gear (145, 188, 255–B, 298, 359, 476–7, 676, 600, 608–9, 740–1, 887, 973, 968, 2381, 2715–0, 2979, 3045, 3088–90, 5174, 5875, 4991)."

153 Description of power reverse gears

2. The paragraph ending on line 14, sheet 3, is not sufficiently comprehensive to permit of a clear understanding of the nature, development, and character of powder reverse gears and omits important facts respecting the same. The following paragraphs should be inserted after line 14, sheet 3:

"The power reverse gear was originally developed beginning in 1904 for use on Mallet or articulated types of locomotives, i.e., locomotives having two complete sets of valve mechanisms (5643, 5903). Although it would have been physically possible to have designed a hand reverse gear which could have been used on such engines with ease, this would have been mechanically awkward on account of lack of room to arrange for increased leverage and counterbalancing which would have been required on account of two sets of valve gears (5788–9). In recent years the increasing width of the fire box of modern locomotives has reduced the available space between the side of the fire box and the outside of the cab, and additional appliances on these modern locomotives have resulted in the necessity of an ever-increasing number of parts and controls being applied to the back head of the boiler and placed within the cab within easy reach of the engineer. These conditions have reduced the available space within the cab to such an extent as to make it mechanically awkward and impracticable to include manually operated reverse gears in designing these modern locomotives and has made
154 power reverse gear a necessary feature of the design thereof, since clearance limits outside of the locomotive would not permit of widening the locomotive cab (5643–4, 5798, 5906).

"The use of power reverse gears was restricted to Mallets until the increased width of fire boxes made power reverse gear a necessary feature of design on new locomotives built in recent years (5576).

"Descriptive circulars put out by several manufacturers of power reverse gears were put in evidence by the complainants, being exhibits 14 (Alco), 15 (Ragonnet), 16 (Franklin Precision), and 17

(Barco); also manufacturers' drawings and lists of parts of some of these gears were put in as exhibits 1, 4, 5, 6, and 7. A reference to these circulars and drawings shows that these gears are constructed upon the common principle of employing the force of compressed air to move the reversing gear in place of the muscular force used by the engineer in adjusting the reversing gear with the manually operated types. To accomplish this, a somewhat complicated mechanism has been developed, constructed about an air cylinder mounted on the side of the locomotive usually just below the running board outside of the cab and at the rear of the tumbling shaft. As will be seen from the drawings, this cylinder is constructed with a piston head upon either side of which air pressure from the main reservoir air supply on the locomotive can be supplied or exhausted through the use of an air valve attached to or connected with the cylinder, the movement of which is in turn controlled by either a lever moving in a quadrant or a wheel within the cab, mounted similarly and designed for operation similar to the manually operated reverse levers and wheels except that the quadrant, levers,
155 and wheels are smaller. It should be noted that these control devices within the cab are designed only to operate the air valve aforesaid, although it will be seen that they are connected by means of a so-called floating lever or combination lever with the crosshead of this power reverse piston which is connected with the piston stem outside of the cylinder, sliding backward and forward on guides, and connected with the reach rod leading to the tumbling shaft. (See exhs. 14, 15, and 17.) The principle of these gears, therefore, is that having adjusted the locomotive valve motion to a given point of cut-off, it will be maintained there by the presence of this air pressure on either side of the power reverse piston head. In the absence of any leakage of air, the position of the piston head in the air reverse cylinder constantly varies with the locomotive in motion and without any movement of the control lever or wheel, moving backward and forward slightly, due to the movement of the valve motion parts. In case of any leakage of air occurring at this air cylinder, or the valve or other connection, a considerably greater movement of the power reverse piston crosshead and reach rod occurs, due to an unequal pressure on the two sides of the piston head (Zouck, 6366–72; Boa, 6323–; 3648–50; 5136–8; 5079–84). It will be noted that the fit and lap of the air valve is cut down to a very small margin, and that the power reverse mechanism consists of a considerable number of separate parts which, assembled together, form this auxiliary air motor. As shown by exhibit 1, the Alco gear has fifty-four separate parts, many of which are small and have to be finished and maintained very carefully in order to make them airtight. The Ragonnet is practically the same gear
156 as the Alco, having, however, somewhat fewer parts. The Barco in an endeavor to get away from the unsuitability of an air cushion to maintain a fixed point of cut-off, has adopted a

worm gear and rack arrangement as shown in the cuts, exhibit 17, and the Franklin Precision for the same purpose has adopted the screw type of control and gear operation (6394, 6366–70, 6375–6, 6316–20, 6322–6). All of them, however, depend upon the presence of main reservoir air pressure on the locomotive for their operation. In case of an emergency where such air pressure is not present, the Alco and Ragonnet depend upon the presence of an auxiliary steam-pressure line which may be cut-in to be used in place of the air pressure. This is unsatisfactory for several reasons as will be shown later herein, and in cases of emergency requiring quick action is well nigh useless. The Barco also is designed for the use of such auxiliary steam line in case of air failure, and it also is so arranged that by removing a cap a wrench can be used if one is in a position to reach the gear, and in that way the valve motion may be manipulated. The Franklin Precision is designed so that in case of air failure it will be possible to reverse the engine by slow stages and by use of an unusual amount of strength with a small hand wheel. This gear is a much slower gear in operation, however, than any other gear—either hand or power—and it is virtually conceded that it is not suitable for use in switching or way-freight service or in any service where frequent reversing of the engine is required (5323–4, 4840, 4856, and others).

"From the above it is apparent that the comparison of any one of these several makes of power reverse gears with any type of
157 manually operated reverse gear, involves the comparison of a rather complicated and quite delicately adjusted auxiliary motor or machine, with a simple tool. The difficulties of the railroads in endeavoring to maintain this auxiliary motor in air tight condition and otherwise in suitable shape for operation, have been many (McFarland, 1740–50, 1773, 1799, abst. 74; Reddix, 3646–57, 3683, 5258–66, exh. 60–65, incl., abst. 88–9; Canady, 5136, 5138, abst., 93; Burnett, 5079–81, 5084, abst., 92; Bjorkholm, 5373–4, 5395, ex. 67, abst., 94; Nye, 5560, abst., 95; Crabbs, 5592–3, abst., 95; Moriarty, 5644–46, abst., 95; Gorman, 5757, abst., 96; Ward, 5795, 5802, abst., 96; Cuningham, 5837; Ford, 5893–4, abst., 96; Kerby, 5904, abst., 96; Hall, 5471, abst., 94–5; Tesch, 3006–8, abst., 82; Von Bergen, 5323–6, abst., 93). Progress nevertheless has been made and is still being made in the development of the power reverse gear. In the matter of overcoming creeping little progress has been made (Burnett, 5079–81, 5084, abst., 92; see cases last above cited; see also additional testimony, abst., 70–97, incl.)."

Connection between valve gear and operating lever or power reverse

3. The sentence appearing at line 17 to 21, sheet 3, inclusive, respecting the connection between the reach rod and the power reverse operating lever, is incorrect and should be revised to read as follows:

"When a power reverse gear of the Alco or Ragonnet type is used the reach rod terminates at the cross head of the power reverse immediately outside of the air cylinder thereof. By
158 means of a so-called floating lever and floating lever rod (sometimes called a combination lever) this cross head and reach rod are connected to the operating lever of the power reverse located in the cab by means of a connecting rod directly connected to this so-called floating lever or combination lever, and this connecting rod by movement of the floating lever operates the air valve supplying air to the power reverse cylinder. (See cuts, exhibits 14 and 15.) The Barco arrangement is similar, the floating lever being attached to the reach rod arm (exh. 17). In the case of the Precision power reverse gear, which is of the screw type, the reach rod leading to the valve motion is directly connected through the air cylinder and power reverse connecting rod to the screw and operating wheel located in the cab. (See cuts, exhibit 16.) Hence any derangement of the valve gear may also be communicated through the reach rod and these connections to the operating lever or wheel in the cab."

Force required to operate manual reverse gear

4. Lines 7 to 15, inclusive, on sheet 10, constitute an incomplete and partially incorrect statement of the facts with respect to matters affecting the force required to move manually operated reverse gear and should be revised to read as follows:

"The connections and bearing parts of the reverse gear and valve gear are fitted with bushings and provided with means of lubrication, and large springs called counterbalance springs are em-
159 ployed to counterbalance the weight of those parts of the valve gear which have to be raised or lowered in reversing the locomotive (5855–70, 5875–7, 108–9). The weight of the valve gear parts has very little to do with the amount of strength required to reverse the locomotive, as larger and more powerful counterbalance springs compensate for the increased weight (5855–70, 5875–7, 108–9, 122, and references cited in exception no. 1 hereof). The tension of these counterbalance springs may be readily increased or diminished, and thus adjusted to fully counterbalance the weight of the parts as desired. These and other needed adjustments may be and are made by the engineers themselves, or reported by the engineers, whereupon they are taken care of by roundhouse and shop forces (5868–70, 1437–38, 2283–4, 1235–6, 108–9, 122).

"Witnesses for both complainants and respondents indicated that the railroads have, within the past ten years, greatly improved in the matter of maintaining their locomotives, including maintenance of hand reverse gears, and that their managements have been helpful in the matter of making the hand reverse gears handle well (385, 572, 3646, 3668–9). While force must necessarily be exerted to move the reverse gear, the evidence shows that proper installation and

adjustment of counterbalance springs and proper lubrication and maintenance of the reverse gears will keep them in condition so that they may be moved freely by enginemen who themselves can control the lubrication and adjustment (Pool, 1093–4, 5868–70, 83–9; abst., 11–23). A number of witnesses stated that the force required to operate the hand reverse gear was increased by steam in the chests or cylinders, but it is shown that this effect will not occur with
160 the piston type of valves nor with slide valves if properly balanced, because the pressure is equalized on the opposing surfaces of the valves (5862–3). In any event, there is, in ordinary locomotive operation no occasion to throw the lever over with the chest full of steam. It is only done in emergencies, and before doing so the steam pressure may be released from the cylinders by opening the cylinder cocks controlled by the engineer in the cab (1158–61, 107–8, 124–5). Witnesses testified to instances where they could not open the cylinder cocks because of the presence of others near the cylinders, but this admittedly can be overcome by turning the cylinder cocks so the nozzles will point inward and downward, thus drawing the exhausting steam underneath the locomotive (Gans, 1022; Brandt, 1158–61). Complainants' witnesses admitted that under ordinary conditions manually operated reverse gears handle without any material difficulty or physical exertion on their part (107, 108, 775, Stone, 61; Price, 510–11; Williams, 662–3; Larsen, 735; Rasmussen, 775; Crum, 863; Rogers, 882; Barton, 919, 931; Paschall, 994; Gans, 1021; Ginder, 295–6, 305; Southard, 510–11; and Rudolph, 695), and that the occasions when the lever works with difficulty are rare and exceptional (Kinnaird, 983; Larsen, 750; and Stone, 102), and this is borne out and fully established by respondents' witnesses, men with many years of engine service, seventy-eight of whom testified on this subject, showing that they had always been able to handle the hand reverse gear without any difficulty and without exerting any undue or unusual amount of strength (1338, 1511, 1619, 1846, 1857, 1876, 1889, 2004–5,
2054–5, 2210, 2283–4, 2312, 2324, 2494, 2505, 2625–6, 2632, 2705,
161 2722, 2860–1, 2889, 2905–6, 2927, 2998, 3099, 3120, 3132, 3169,
3192, 3248, 3345, 3401, 3414, 3440, 3452, 3495, 3531, 3543, 3553, 3830, 3850–1, 3864–5, 3891, 3926, 3948, 3984, 3997, 5087, 5315, 5381, 5464, 5746–7, 5891, and 5906, abst. 11–23). The testimony on both sides of the case shows very definitely that the handling of manually operated reverse gears has in no way adversely affected the health or physical condition of the men (1234, 1338, 1511, 1531, 1540, 1512–14, 1631, 1646–47, 1688–89, 1818–19, 1845–46, 1856, 1876, 1893, 1902, 1920, 1991–92, 2076, 2284, 2312, 2316, 2383, 2493, 2497, 2505, 2511, 2524, 2632, 2694, 2730, 2928, 3031, 3055, 3169, 3192, 3237, 3270, 3310, 3345–46, 3401, 3414, 3440, 3445, 3531–32, 3689, 3774, 3792, 3831, 3851, 3865, 3891, 3901–02, 3927, 3984–85, 3998, 4826, 4856, 4859–60, 4950, 4949, 5464, 5614, 253, 254, 362, 386, 436, 515, 676, 740, 753, 756, 789, 825, 1139, abst., 24–31)."

Comparative strength required to operate manual and power reverse gears

5. The two sentences included in lines 15 to 21, inclusive, sheet 10, regarding comparative strength required to operate the two types of gears are not incorrect, but the following should be added thereto in order to complete the statement and facilitate a complete and correct understanding of the evidence:

"In general, less strength is required to be exerted by the enginemen in operating power reverse gear than in operating hand reverse gear, although not true in all cases (2998, 3009–10, 3054–6, abst., 17; 4856, abst., 21; 4881, abst., 22). Power reverse gear is consid-
162 ered generally as a labor-saving device and desired by some enginemen for that reason (2382, 515, 4993, 4975, 5662, 5492–4; and abst., 24–5), but many enginemen prefer to operate with the hand reverse gear because they find it less tiresome and feel better physically when using engines equipped with it, and because they have found from experience that they can more positively and accurately control the adjustment of the locomotive valves with hand reverse gear (2494, 2497, abst., 15; 1991–2, abst., 27; 1893, abst., 26; 3055, abst., 28; 3531–2, abst., 32; 3831, abst., 29; 1402, abst., 115; 1929, 1936, abst., 116; 2308, abst., 117).

Manually operated reverse lever latch

6. The sentence included in lines 8 and 9 on sheet 11, regarding the function and operation of the manually operated reverse lever latch is a partially incorrect statement, raises an inference which is contrary to the evidence, and should be revised to read as follows:

"The latch is designed to lock the reverse lever in any desired position in the quadrant, and the record affirmatively shows that in the absence of defects or breakage it does so effectively and positively, and by so doing maintains the valve gear of the locomotive at any desired adjustment of valve travel and cut-off (5324, see abst., 97–112)."

Accident evidence characterized and compared—both gears

7. The following statement of facts appearing in lines 12 to
163 18, inclusive, on sheet 11, with respect to accidents occurring in connection with the operation of reverse gears, is incomplete and inaccurate:

"In the operation of locomotives many engineers, as well as others, have been injured by being struck or jerked by the hand reverse lever. Such accidents have occurred under varying circumstances and conditions. Accidents have also occurred on locomotives equipped with power reverse which defendants urge would not have occurred if the locomotives involved had been equipped with hand reverse."

This statement should be corrected to read substantially as follows:

"The complainants' proof in this case is limited to a showing that a considerable number of injuries have occurred to engineers or firemen in the cab on engines equipped with manually operated reverse gears. They assert that these accidents would not have occurred if those engines had been equipped with power reverse gears and they seek an order from this Commission requiring the installation of power reverse gears upon all locomotives, based upon the inferences which they draw from these cases. Respondents take the position that the evidence produced by the complainants, standing alone, wholly fails to prove their case and would in no way justify the Commission in entering an order requiring either wholesale installation of power reverse gears, as demanded by complainants, or such installation upon any of the locomotives now equipped with manually operated gear. The respondents also made an affirmative showing of a considerable number of accidents occurring to enginemen, shop men, and others, in connection with the use and
164 maintenance of power reverse gears. Respondents also offered to prove additional accidents of this character in the form of reports made by the carriers to the Commission's Bureau of Statistics, but is was deemed improper to admit this proof on behalf of the carriers, although 216 cases relied upon by complainants, were proved in this manner (1185–94, 5844–8). The accidents shown of record in connection with power reverse gears are therefore less numerous than the accidents shown in connection with hand reverse gears, but this does not mean that fewer such accidents have occurred. Defendants could have matched complainants' proof numerically only piling up evidence of additional accidents through additional witnesses.

"The power reverse gear accidents of record in this case include accidents of a character similar to those occurring with hand reverse gears and include several other kinds of accidents, some of them involving employees other than enginemen and others involving serious danger to the traveling public (abst., 135–167). The power reverse gear accidents of record in this case, while not as numerous as those with hand reverse gear, are, on the whole, of a more serious nature and involve nine fatalities which it is shown would not have occurred had the locomotives in question been equipped with hand reverse gears (1857–69, 5820–2; abst., 137, 161, 2335–44; abst., 140; 2820–6, abst., 145–6; 4826–38, 4945, abst., 151–2; 5146–56; abst., 156–7; 5209–15, abst., 158; 5969–83, abst., 165–6; 4861–78, 4885, 4951–7, abst., 152–4; 2848–52, exh. 36, abst., 146)."

Issue of fact restated

8. At lines 27 to 30, inclusive, sheet 11, the issue of fact is stated as follows:

"The question of fact presented for the determination of
165 the Commission is whether the use of locomotives equipped with hand reverse gear, as compared with power reverse gear, causes unnecessary peril to life or limb."

While this is an admirably brief statement, exception is taken thereto because it does not, standing alone, state the issues as made by the pleadings and proof. To accomplish this, the following statement should be added to the above:

"By their complaint the complainants have assumed the burden of proving (1) that manually operated reverse gears are so unsuitable and unsafe that the Commission should find that any and all locomotives equipped with such type of reverse gear are unsuitable and unsafe to operate and cannot be operated in the service to which the same are put without unnecessary peril to life or limb, and (2) that if any and all such locomotives were equipped with power reverse gears they would then be safe and suitable for such operation and the use of such power gears would eliminate all unnecessary peril to life and limb. The complaint prays for an order of this Commission requiring the installation of power reverse gears or 'other devices adequate to protect the employees upon said locomotives from unnecessary peril to life and limb.' Hence, to justify an order requiring the installation of power reverse gears in this case, it must appear that they are the only device which will adequately accomplish the desired degree of safety if unnecessary peril is found to exist on account of the use of hand reverse gears."

166 Statement of complainant's accident cases corrected

9. In the statement of accidents covered by testimony of complainants' witnesses appearing on sheets 12 to 16 inclusive of the proposed report, the following changes and additional relevant facts should be made and set forth in order to accurately and completely summarize the evidence:

(1) Add the following to paragraph numbered 1, sheet 12:

"Following the accident the witness made this statement to the claim agent: 'There was nobody to blame for this accident, which would have been avoided if I had properly inserted reverse lever latch in quadrant. No defects in engine' (3290; abst., 42)."

(2) Add the following at the end of paragraph numbered 2, sheet 12:

"This engineer stated the engine was defective and had been defective for quite a while making reverse lever work hard on account of 'leaking steam in the steam chest' and 'every engineer in the yard reported this engine' (141, 143; exh. 11). The Bureau of Locomotive Inspection report states: 'The herein mentioned locomotive was engaged in switching service and the engineer was in the act of throwing over the reverse lever when he got a crick in his back which caused his probable disability as stated herein.'

"The engineer stated that cylinder was full of steam, and in pulling lever back wrenched his back. He did not claim that injury was caused by any mechanical defect."

167 (3) The following should be added to paragraph numbered 3, sheet 12:

"Difficulty operating this reverse gear was due to Southern valve motion of which they have no more. Engine was standing on curve. When not standing on curve 'she would not bind and you could throw her over as nicely as you wanted to' (190–191)."

(4) Add the following to paragraph numbered 5, sheet 12:

"This was the hardest working gear witness ever had, and the hernia was caused through overexertion the same as would follow any heavy and continuous strain (230–1, 235)."

(5) Add the following to paragraph numbered 6, sheet 13:

"Bureau of Locomotive Inspection report shows the following:

"'The reversing gear reach rod 1⅜" too long. The corners of the rear reverse lever latch worn off. The rear bolt holes of the inside and outside reverse lever latch were enlongated ⅛". Reverse lever reach rod jaw bolt worn. Right valve rod bolt worn. Left valve rod loose on stem. No doubt this accident would have been avoided had the reported valve gear defects been given the proper attention' (exh. 11)."

(6) Add the following to paragraph numbered 7, sheet 13:

"B. of L. I. investigation reports shows the following:

168 "'From statements obtained, my investigation develops that after coming to a stop engineer Diller moved the reverse lever ahead from its "back-motion" position, then opened the throttle. The engine would not move due to the fact that the reverse lever was not moved far enough ahead or passed its natural position. He (engineer) then closed the throttle and with some considerable effort succeeded in forcing the reverse lever over the center into forward motion, which immediately released the steam pressure in the steam chest; after which the reverse lever operated easily and, according to his statement, he could operate the reverse lever with one hand. It was while in the performance of the above operation that he sustained the injuries as stated.'

"In connection with the above, it was first stated by engineer Diller to this effect, that the throttle valve came open and he did not know it was open until he went to reverse the engine and could not push the reverse lever passed the center. He then closed the throttle and the fireman held the throttle lever closed while he forced the reverse bar over the center, then it flew down in the corner causing his injuries. He afterwards contradicts his own statement and states that the reverse bar did not jump ahead, but simply moved ahead due to his effort and moved easier as he succeeded in getting it over the neutral point. This, of course, uncovered the steam ports and thus released the entrapped steam in the steam chests. Fireman Zech contradicts engineer Diller by stating that Diller moved the reverse lever ahead and pulled the throttle open, but the engine did not move, due to he not having pushed the bar over the center.

169 He (Diller) then closes the throttle and he (fireman Zech) voluntarily steps over and holds the throttle lever in closed position while Diller forces the reverse lever over the center. When Zech took his hand off the throttle lever, it stayed right

there. Diller states that the throttle lever would spring back about three notches on the latch quadrant, but on this occasion it sprung open 5 or 6 notches, but further states that it never did this before or after. Fireman Zech states that he handled the engine for three hours after this occasion and did not have any trouble with the throttle or reverse lever.

"In my opinion this accident was caused by the engineer hurriedly forcing the reverse lever from neutral to forward gear with steam pressure entrapped in the steam chests, while the engine was standing. Nature and extent of injuries—contusion of left lower back and side. Rupture of ligaments of left lower side (exhibit 11)."

(7) Add the following to paragraph numbered 8, sheet 13:

"If engine had been equipped with a hand reverse, this accident would not have occurred (285)."

(8) Add the following to paragraph numbered 10, sheet 13:

"This injury resulted because valve parts and valve motion were too tight on engine just out of shop, and counter-balance spring had not been adjusted to sufficient tension (348), and the small-teethed type of quadrant did not hold the lever as securely as ordinary type of quadrant with large teeth and deeper notches (336)."

(9) Add the following to paragraph numbered 11, sheet 13:

170 "If this engine had had a lubricator which could be reached by standing on running board or from witness' position in seat box, witness stated he would not have been hurt (372; abst., 50)."

(10) Add the following to paragraph numbered 12, sheet 13:

"Witness got this engine from another crew and did not bother to examine lubricator, taking it for granted it was all right. Plenty of oil, but wasn't feeding enough (396). His pulling the lever in back motion as engine was going ahead and the lever then going forward when latch was released, had a lot to do with cause of accident (397; abst., 51)."

(11) Add the following at the end of paragraph numbered 14, sheet 13:

"If witness had kept his foot on floor in front of him or any other place to brace himself he would not have been injured. He stated he was not conscious of having put foot in way of lever (456; abst., 51)."

(12) Add the following to paragraph numbered 16, sheet 13:

"Engineer's leg was caught between air pipes and lever (545, 551; abst., 56)."

(13) Add the following to paragraph numbered 21, sheet 14:

"Engine was just out of shop. Witness had no trouble with this engine since, as he put in a stop pin and fixed it so there was room for his feet (704–05, 713; abst., 46)."

(14) Add the following paragraph numbered 22, sheet 14:

171 "The hernia occurred (became strangulated) nearly one year after the above mentioned accident, and operation took place thereafter. This was caused by witness stumbling and

falling and having a fit of coughing as he was leaving his boarding house (746)."

(15) Add the following to paragraph numbered 23, sheet 14:

"Engine 29 had been on storage track at shop for at least a month before this trip (760–61). If witness had kept his foot where he had it at first he never would have slipped (761). Prior to trip witness failed to oil the links and driving boxes (762; abst., 52)."

(16) Add the following to paragraph numbered 22, sheet 14:

"The valves were dry and apparently no steps were taken to relieve this before trying to force lever. Because of position witness was placed in, throwing all of his weight on one foot, and leaning around the corner, he thus caused the strain (771–72; abst., 46)."

(17) Add the following to paragraph numbered 25, sheet 14:

"The jumping of the lever to forward motion was due to either worn quadrant or quadrant had dropped a little (813; abst., 53)."

(18) Add the following to paragraph numbered 27, sheet 14:

"Cause of lever going to corner due to some one putting excessive amount of oil on reverse lever latch and same getting on
172 quadrant; also stop pin in forward end of quadrant was missing and witness had not observed this (846). After accident quadrant was washed and there was no more trouble (853; abst., 53)."

(19) Add the following to paragraph numbered 31, sheet 15:

"Witness stated strain was due to his own exertion and not from movement of the bar (928). The only injury witness ever received with hand lever during 23 years' handling of them (930; abst., 47)."

(20) Add the following to paragraph numbered 32, sheet 15:

"The foregoing statement is taken from report of B. of L. I. inspector from investigation after accident. His report also shows the reverse lever had broken off below the quadrant at a point where it had been welded and the weld was 60 percent defective. This strongly suggests that the giving way of this defective weld caused valve gear to go in forward motion. The broken off top portion of the lever was found lying in the gangway beside engineer following accident, evidently having struck engineer (exh. 11; B. of L. I. investigation report; 54–5)."

(21) Add the following to paragraph numbered 33, sheet 15:

"This was the only time witness strained or injured himself in using hand reverse gears in 35 years of service as an engineer (986–7; abst., 47)."

(22) Revise and amplify paragraph numbered 34, sheet 15, so same will read as follows:

173 "Engineer was not physically able to reverse his engine. It became necessary to take slack. Fireman after having put the engine in back motion got behind the lever (evidently standing on the deck) and braced his foot behind him against the tank to push the lever in forward motion. While pushing on the lever his foot slipped off which stretched him out and caused a rupture on the right side. Off duty for 14 days (997–9, 1002–03; abst., 47)."

(23) Add the following to paragraph numbered 35, sheet 15:

"About five months prior to this accident witness had bumped this same knee in climbing on the engine and a knot formed under it which had to be lanced and thereafter continued to discharge pus until the above-mentioned incident occurred. Witness presumed the knee had been weakened by the first injury, but could not state positively. The first injury had nothing whatsoever to do with use of the hand lever (1023–24)."

(24) Add the following to paragraph numbered 36, sheet 15:

"Witness admits that he had trapped steam in cylinders and did not take time to open the cylinder cocks and drain the steam (1041). Witness stated lever did not kick or injure him but it was his strain trying to throw it over (1043; abst., 47)."

(25) Add the following to paragraph numbered 37, sheet 15:

"Witness stated that if he had been sitting on seat box next to cab window, he might have been out of the way of lever (1090; abst., 48)."

174 (26) Add the following to paragraph numbered 38, sheet 16:

"Witness stated accident not caused by any inherent defect in the reverse lever (1111–12). The only injury witness has sustained with manual reverse lever in 18 years of engine service (1099, 1112, abst., 49)."

(27) Add the following to paragraph numbered 39, sheet 16:

"This is the oldest engine they have in service in witness' territory (1128). Witness said he had his legs sticking outside of the box and there was plenty of room for him to get his legs out of the way; lots of room between the quadrant and the cab (1129–30; abst., 53)."

(28) Add the following to paragraph numbered 40, sheet 16:

"Stop block was missing from front of quadrant (1139–42). Counterbalance spring had been out of balance all that day, and witness made no attempt to adjust it, although he admits it would have taken about 10 minutes (1165–67). Another accident about July or August 1927, witness' foot slipped from boiler and wedged against side of boiler, injuring the arch of his foot slightly (1142–43; abst., 54)."

Bureau of statistics accident reports—Statement corrected

10. The sentence appearing at lines 14–19, inclusive, sheet 16, incorrectly characterizes copies of certain accident reports which
175 were introduced in evidence by complainants over respondents' objections in that it refers to them as covering accidents which occurred in the operation of or due to the action of the reverse gear. This is a correct characterization of some of these accidents, but nevertheless a number of them appear on the face of the reports to have occurred entirely independent of operation or action of re-

versing gear. We respectfully suggest that the following be substituted for the above mentioned sentence:

"Copies of 231 accident reports made by class 1 carriers to the Commission's Bureau of Statistics during the years 1929 and 1930 and filed by the Bureau under classification no. 6316, table 73, Reverse Levers, Operating (4932–34, compl. brief 54), were received in evidence on behalf of complainants over respondents' objections. It was subsequently shown that 11 of these reports covered accidents occurring on engines equipped with power reverse gears (exhibits 13 and 49). Ten of these reports covered cases regarding which witnesses testified, but as to the remainder no witnesses were presented. Most of these reports furnish so little detail as to be of no real aid in determining the issues in this case."

Corrected statement power reverse gear accidents

11. The statement appearing under the heading "Power reverse gear" and beginning on sheet 31 and extending to the end of the paragraph numbered 69 on sheet 40 of the proposed report, is
176 incorrect and incomplete to the extent indicated by the suggested changes and corrections set forth below, and should accordingly be corrected as thus indicated in order to constitute an accurate and reasonably comprehensive statement of the relevant facts:

(1) The unnumbered paragraph at the top of sheet 31 should be revised to read as follows:

"The following 12 accidents were shown by form T reports introduced by complainants as exhibit 13, supposedly covering accidents occurring on engines equipped with manually operated reverse gears. It subsequently developed that in these 12 cases the engines involved were equipped at the time of the accident with power reverse gears (exh. 49)."

(2) Strike out paragraph numbered 5 on sheet 31.

(3) Add the following to paragraph numbered 12, sheet 32:

"Power reverse piston broke while on road (exh. 13 and 49)."

(4) Strike out paragraphs numbered 14, 15, and 16, sheet 32.

(5) A number of witnesses testified on behalf of defendants regarding accidents which have occurred on locomotives equipped with power reverse gear. The testimony of these witnesses was in certain instances supplemented by reports made by the carriers to the Commission and in other instances by reports covering investiga-
177 gation of the accidents by the Commission's inspectors. The facts as to these accidents are briefly set forth in the following:

[NOTE.—To avoid unnecessary duplication defendants by this reference hereby incorporate herein the printed statement of accidents included in section IX of their abstract filed herein, at pages 135 to 167, thereof, with the page references to the record therein shown. This printed statement should be substituted for paragraphs 17 to 69, inclusive, sheets 32 to 40, inclusive, of the proposed report.]

Failure to remove power reverse gear not significant

12. Respondents except to the following sentence appearing at lines 13 to 18, inclusive, sheet 40:

"While these accidents are now attributed by defendants to the fact that the locomotives were equipped with power reverse gear, it is significant that in no case was the power reverse gear removed after the accident and hand reverse substituted. The locomotives involved, if in use, are still equipped with power reverse gear."

because it carries implications or conclusions entirely unwarranted by the evidence, and irrelevant to the issues in this case. Whether or not respondents previously attributed these accidents to the fact that the locomotives in question were equipped with power reverse gear is entirely unimportant and insignificant in view of the

178 facts which definitely and affirmatively appear in the evidence and are uncontradicted, to the effect that these accidents in a great majority of the cases, would not have occurred had the locomotive in question been equipped with hand reverse gears (1392–96, 1527–30, 1558–9, 1608, 1621–22, 1819, 1825–6, 1857–63, 1865–6, 1868–9, 1877–78, 1993–7, 2143, 2199–2200, 2213, 2215–19, 2288–89, 2414–17, 2290–2, 2305–08, 2335–44, 2396–99, 2400–08, 2520, 2516–18, 2522–2537–8, 2535, 2555–6, 2542–50, 2609–15, 2634, 2670–72, 2665–8, 2673–77, 2669–70, 2694–5, 2700, 2748–54, 2774–8, 2807, 2820-26 2848–52, 2880–1, 2968–71, 2975, 3062–64, 3102–03, 3252, 3253–6, 3469–71, 3534–5, 3705–12, 3758–60, 3798–3806, 3893–95, 3972–73, 3978–80, 3999, 4826–39, 4842–43, 4945, 4885, 4861–78, 4945, 4890–92, 4893–4900, 4969, 4951–59, 5091–95, 5105–07, 5110–12, 5115–18, 5120–23, 5146–53, 5156, 5158–9, 5184, 5188–90, 4191–94, 5203–05, 5206–08, 5209–15, 5222–25, 5528–31, 5236–40, 5250–52, 5254–6, 5820–22, 5415–17, 5436–38, 5454–56, 5459–60, 5472–74, 5565–66, 5617–21, 5739–42, 5990–96, 6034–6; see cases marked "(b)" to "(f)", inclusive, abst., 135–167), and in the few cases where they would have occurred if the locomotives were equipped with hand reverse gears, it affirmatively appears that the accidents were of the same identical kind relied upon by complainants with respect to hand gears (1387–89, 1516–17, 1525–26, 2633, 2668–69, 3031–32, 3104–05, 3317–28, exh. 40 and 90, 3320, 3329–39, 3676–77, 3969–70, 5124–27, 5216–19, 5221, 5243–46, 5616–17, 5959–61, 5965–66, 5969–77,

179 5979, exh. 101, 5980–83; see cases marked "(a)", abst., 135–167). There is no significance properly to be attached to the fact that in no case were these power reverse gears removed after the accident and hand reverse gears substituted. It is likewise a fact that in the case of the hand reverse gear accidents, the hand reverse gears were not removed and power reverse gears substituted for them following the accidents, nor were power reverse gears used as a safety device in these or any other cases. The uncontradicted evidence in this case is to the effect that neither the hand reverse gear nor the power reverse gear has ever been used as a safety device; that power reverse gear has never been applied by any railroad, nor ever been held out as a device to promote safety (4971–2, 4975, 4993, 5314–

15, 5326, 5405, 5468, 5496, 5492–4, 5578–80, 5643, 5662–5, 5748–50, 5752, 5785, 5788, 5798–99, 5802–05, 5818–19, 5906). The evidence shows that on no occasion where the engineman requested these power reverse gears to be installed did they do so in the name of safety (4974–5, 4993–4, 4997, 5375–6, 5468, 5684, 5788); and that although a great majority of the engineers who testified considered the hand reverse gear in some respects safer than the power reverse gear (abst. 126–135), yet neither device, from a safety standpoint, can be considered to the exclusion of the other (5326, 5405–06, 5818–19, 5468; also see citations second above).

It is our suggestion that the above paragraph be eliminated from the report or that a paragraph be substituted for it which will state the relevant facts as follows:

"In most of these cases the accident would not have occurred
180 had the locomotive been equipped with manually operated reverse gear at the time of the accident. In the few remaining cases substantially the same result might reasonably have occurred had the locomotive been equipped with manually operated gear. No significance should be attached to the fact that these power reverse gears were not replaced with hand reverse gears following the accidents; neither should any significance be attached to the fact that in the case of hand reverse gear accidents those gears were not removed and replaced by power reverse gears following the accidents, as it is undisputed that neither of these devices has ever been considered or applied as a safety device, and neither of these devices has been considered to the exclusion of the other from a safety standpoint (5405, 5326, 5493–6, 5752; and citations above). The evidence establishes the facts that power reverse gears now in use on respondents' locomotives were placed on these locomotives because of necessity and desirability from the standpoint of design of these locomotives and not in any instance for the purpose of promoting safety (5468, 5493–6, 5784–6, 5576, 5579, 5583, 5906, 5643–4, 5662, 5798, 5802, 5804–5). Although the evidence shows instances where the earlier types of power reverse gears have been removed from locomotives and hand reverse gears substituted for them (5751–2, 5761–2, 5798–5802), yet in other instances where this occurred the gears removed were replaced with a later type of power reverse gear (5469, 5893, 5798–5802)."

181 Statistics and comparative accident data

13. The following five sentences appearing at lines 22 to 36, inclusive, sheet 40, incorrectly state the facts:

"The record shows that during the five-year period from 1925 to 1929, inclusive, there were 1,116 casualties due to reverse gear. The proportion of such casualties occurring on locomotives equipped with hand reverse gear is illustrated by the fact that of 233 cases occurring in 1929 and 1930 a total of 217 occurred on locomotives equipped with hand reverse gear and 16 on locomotives equipped

with power reverse gear. During the latter period there were about the same number of locomotives in service with power reverse gear as with hand reverse gear. It is our understanding that the record contains the facts as to practically all accidents which have occurred on locomotives equipped with power reverse gear and in which the reverse gear was involved. On the other hand the record and the above analysis cover in detail only a small proportion of the total accidents which have occurred on locomotives due to hand reverse gear."

and should be revised to read as follows:

"The record shows that during the five-year period from 1925 to 1929 there were 1,116 accident reports made by class 1 carriers to the Commission's Bureau of Statistics involving injuries to engineers or firemen and filed by that Bureau under its classification, 'Reverse levers, operating' (exhibit 53; Warfel, 4929–33; compl. brief 54). The record further shows that in common with casualties of all kinds occurring to engineers and firemen during this period, reverse
182 gear casualties decreased very rapidly, and that taking the figures from these sources for the year 1930 only 71 reported accidents filed under this classification were found reporting injuries to engineers and 5 as to firemen—these figures comparing, respectively, with 255 and 30 for the year 1925 (exhibit 54; Warfel, 4931). It is also shown that the total accident reports filed with the Commission under the above classification during the years 1929 and 1930 equal 317 (exhibit 53; 4937–39). As exhibit 13, complainants introduced in evidence copies of reports covering 231 of these 317 cases for the years 1929 and 1930, and it subsequently developed that in 11 of those cases the engines were equipped with power reverse gears at the time of the accident (exhibits 13 and 49). Assuming that all of the remaining reports for these two years which were not introduced by complainants covered cases where the locomotives were equipped with power reverse gears, this would indicate only 97 power reverse gear accidents reported and filed under this one classification during those two years. This, however, constitutes no accurate indication of the comparative frequency of accidents with the two classes of gears, because accidents with power reverse gears are of a more varied character, and from the accidents shown of record in this case it is quite apparent that many of them are such as would not properly or logically be filed under the Bureau of Statistics' classification above mentioned, and it affirmatively appears that numerous power reverse gear accidents, other than those filed under this particular classification of the Commission's Bureau of Statistics, will be found scattered broadcast through the Commission's other classifica-
183 tions, and that in order to ascertain the number of these accidents it would be necessary to examine all of the individual accident reports filed by the carriers year by year and sort out the power reverse gear accidents, as there has been no segregation of them and no statistics regarding them are available save under this one classification (Warfel 4932–39). Accidents to engineers and

firemen, as reported and filed under this classification for the last year available at the time of the hearing (1930), are shown to have involved 6.6 percent of all injuries received by engineers from all accidental causes, and three-tenths of one percent in the case of firemen. In that same year 53 engineers and 49 firemen were killed as a result of accidents, but no one of these casualties was a power reverse gear accident filed under the above-mentioned classification (Warfel, 4931). During the years 1925 to 1929, inclusive, no deaths were reported and filed under this classification, although many engineers and firemen were killed during those years (exhibit 53). The evidence shows no case where any one was killed in operating a hand reverse gear, or as a direct result of its operation, although a number of such deaths have occurred in connection with the operation of power reverse gears. Because of a broken throttle wedged in open position, one death and some serious injuries occurred in one case on a runaway locomotive equipped with hand reverse gear. This death and these injuries would have been prevented if the hostler handling the engine had been able to reverse the engine with the hand reverse gear. Had that locomotive been equipped with a power reverse gear because of insufficient air pressure to operate the gear the same result would have occurred (Wyatt, 6267–71)."

184 Opinion evidence summarized

14. The first paragraph on sheet 41 referring to the opinion evidence in the case is incomplete, and the conclusion therein stated is unwarranted because it ignores a large number of unimpeached and uncontradicted opinions by witnesses based upon many years experience, each, in engine operation with both type of reverse gears, which are supported by much uncontradicted testimony regarding accidents. We suggest the following as a comprehensive and correct statement characterizing the opinion evidence in lieu of the above-mentioned paragraph:

"Of the forty-four witnesses who testified for the complainants, only eight expressed an opinion as to the relative safety of the hand and power reverse gear.

"All of them expressed the opinion that power reverse gears are safer than hand reverse gears. It is evident from their testimony that they were confining their opinions to the possibility of injury to enginemen while in the cab, and that their opinions were based solely upon their having been injured with a hand reverse and not with a power reverse, and their expressed belief that there is no chance of injury with power reverse, which belief admittedly would have been changed had they known of accidents causing injury in operation of power reverse gears (146, 207, 301, 495, 502, 532, 546–51, 611, 708–709, 703–5, 709; abst., 126–7).

"None of the seventy-odd witnesses for respondents who testified as to the relative safety of the hand reverse and power re-
185 verse gears (see abst., 127–135) were of the opinion that hand reverse gears were unsafe (1251–2, 1347–8, 1852, 2328, 2731,

3176, 3749, 3950, 5654), nor did they consider the power reverse gear unsafe (1347–8, 2806, 2884). Some were of the opinion that with respect to safety there was no difference (2228, 2308, 3037, 3272, 3471, 3856, 5406, 5706, 6005).

"A large majority, however, were of the opinion that hand reverse gears are safer (1321–2, 1402, 1476, 1595, 1622–3, 1655, 1713, 1815, 1936, 1998, 2030, 2078, 2105, 2250, 2095, 2377, 2446, 2557, 2615–6, 2677, 2703, 2754–5, 2857, 3068, 3105, 3150, 3283–4, 3422, 3519, 3533, 3545, 3570, 3698, 3772, 3797, 3877, 4003, 4901, 4971, 5159, 5326–7, 5061, 5674, 5818). This testimony was presented not only by enginemen but also by machinists and mechanical officials. They did not base their opinions merely upon the hazard to enginers in the cab, as was done by complainants' witnesses, but took into consideration all hazards on or about the locomotives.

"Among the reasons given by those witnesses who considered the manually operated reverse gear safer than the power reverse gear, the following are some of the principal ones:

"(1) Positive control with hand reverse regardless of presence of air pressure (1476, 1622–3, 2295, 2557, 1347–8).

"(2) In oiling around engine more caution required with power reverse on account of possibility of movement of valve gear while air pressure being pumped up (1595, 5326–7, 5472–5, 1321–2).

"(3) Considering the safety of all classes of employees, hand reverse gear is safer (2446, 4971, 5951, 1402).

"(4) The hand reverse gear will hold the engine standing without air (2557).

186 "(5) Because you can see and know what the manually operated reverse gear is doing at all times (2677).

"(6) Hand reverse is safer in emergencies in controlling locomotives (4003, 4901, 5326–7, 5472–5, 5601, 5990–3).

"(7) Hand reverse considered safer because of cases where locomotives with power reverse have moved in opposite direction to that intended by position of power reverse lever due to absence of adequate air pressure (5326–7, 5472–5, 5760, 5763).

"(8) Accidents incident to power reverse gears are generally of a far more serious nature than those incident to manual reverse gears (5326–7, 5803, 5818).

"A number of witnesses stated that in their opinion there is no advantage of either type of gear over the other from a safety standpoint (2228, 2308, 3037, 3196, 3272, 3471, 5706). Others indicated their opinions, based on years of experience operating hand reverse gears, that such gears do not interfere with safety of operation in any way (1515, 1347–8, 1251–2, 1300, 1852, 1870, 2328, 3176, 3749, 3950).

"Mechanical officials of long experience in both operation and supervision of operation of locomotives gave it as their opinion and judgment that so far as operation of the levels are concerned the manual and power reverse levers are both safe devices and from the standpoint of safety of life and limb of the enginemen. All were

firmly of the opinion safety would in no way be promoted by substituting power for manual gears (5326, 5405–6, 5493–6, 5752, 4954–7, 5468, 5475, and references above in exception no. 12. 32–3, hereof)."

187 Most cab clearances are sufficient and accidents resulting from insufficient clearances are preventable without applying power reverse gears

15. Lines 8 to 28, inclusive, sheet 41, with reference to clearances in the locomotive cab, accidents resulting from close clearances and the use of stop blocks or stop pins, incorrectly and incompletely summarize the evidence of record on these subjects, and omit reference to certain important and relevant facts respecting same which should be stated. We respectfully suggest that the said lines be revised and amplified to read as follows:

"The accidents which have occurred on locomotives equipped with hand reverse gear are attributable to several causes. On some locomotives the hand lever is located behind the boiler head and at the side of the engineer's seat box. The clearance between the lever (when in back motion position) and the back board of the cab on some engines is shown to be very small. In fact, on some locomotives the lever when in extreme backward position extends beyond the back board of the cab, the back board being cut out to permit the lever to pass. On a few locomotives the clearance between the lever and the seat box as well as between the lever and the boiler head and appurtenances thereon is also small. Many of the accidents relied upon by complainants occurred due to engineers, or others acting as engineers, being caught between the hand reverse lever and the other parts referred to, due to the close clearance provided, oftentimes accompanied by carelessness. On some locomotives stop blocks or pine are provided near the ends of
188 the quadrant for the purpose of limiting the travel of the reverse lever so that it will not come in contact with the back board or the boiler or the appurtenances located thereon. If the stop block is missing there is in most cases nothing to prevent the lever from coming in contact with the boiler or the cab, and a number of accidents relied upon by complainants occurred because this condition existed.

"While the amount of space available for the engineer in the cab is necessarily limited and the lever or wheel of a manually operated reverse gear must be close enough to him that he may conveniently reach and use this controlling device, it by no means follows that he cannot keep himself entirely free of the lever or wheel at all times.

"It was admitted in a number of the cases presented by complainants that the injured man had sufficient space in which to sit or stand (as he might desire) entirely in the clear of the lever or wheel, and it follows that if he had done so the injury would have been avoided

(Stone, 100, 2920; Pool, 1090; Snoddy, 456; Stringer, 761; Young, 1129–30).

"There is no necessity for the engineer placing himself in a position to be injured by the hand lever or wheel (5316–7, 5464, 5467–8, 5763–4, 5653, 2932), and while there is testimony indicating an insufficient amount of clearance between the hand reverse lever and the boiler head or back board, air pipes, or brake valve on certain of the older and more obsolete locomotives (161–2, 386, 392–3, 438–41, 501), yet there is much testimony by witnesses on behalf of both sides in this case indicating that on the vast majority of engines now in service equipped with hand reverse gears, these clearances are sufficient and there is ample room in the cab for the engineer to safely and conveniently engage in his duties in operating the locomotive (536, 5466, 5746–9, 5893, 5903, 5310–13, 1261–2, 1807–9, 1845, 1893–4, 1934–6, 1988–91, 2055–8, 2324–5, 2312–3, 2511, 2694, 2741–2, 2931–2, 3002–3, 3041, and many others). The testimony further shows that where clearances have been found to be insufficient, these conditions have been, or may readily be, remedied by changing the location of air pipes or brake valves, installing stop blocks or pins, and cutting out or rearranging back boards (5466–7, 163–4, 963, 713, 1156, 484–5, 5893, 2998–3003). If on any such locomotives now in operation insufficient clearances exist, they will no doubt readily be detected by the inspectors of the Bureau of Locomotive Inspection. Accidents of this character, which constitute a considerable portion of the accidents relied on by complainants, are thus preventable by providing adequate clearances in the manner suggested (42, 963, 713, 1156, 484–5, 167–9, 456–9)."

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Cab clearances are sufficient and there is no occasion for engineer to place himself so as to be hurt by manual reverse lever

16. The two sentences included in lines 29 and 30 on sheet 41, and lines 1 to 4, inclusive, on sheet 42, inaccurately and incompletely state the facts as shown by the record with respect to clearance conditions within locomotive cabs, and should be revised and amplified to read substantially as follows:

"It will be appreciated that the space in which the engineer must work while operating the locomotive and while in his usual and proper position in the cab, is limited by the inside width and length of the cab, the width of the boiler head and the distance it extends back inside the cab, and the location of various pipes, appurtenances and controls, which are mounted upon the boiler head and elsewhere, within convenient reach of the engineer; also by the relative location of the seat box, the backboard of cab and the reverse lever or wheel. The design and location of all these things vary greatly on the locomotives of different railroads and also upon different types or classes of locomotives on the same railroad. The increased width of the fire box and boiler head on the

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larger and more powerful locomotives which have been built within recent years, and an increasing number of controls and appurtenances to be mounted upon the boiler head and installed within the cab, have reduced the available space on these modern high-powered engines to such an extent that the mechanical engineers and superintendents responsible for the design of those locomotives, have considered installation of manually operated reverse levers thereon would be impracticable and mechanically awkward, and for that reason the power reverse gear with its smaller quadrant and lever or wheel, which do not take up as much room in the cab, and for that reason may be used in a shorter cab and in the smaller available space on these modern locomotives, has been installed thereon 5643–4, 5798, 5906, 5662, 5500, 5576, 5579, 5583, 5785, 5700–1, 5706–7, 5802–11, 5818 et als.). As mentioned above as to the older locomotives which are equipped with manually operated reverse gears, while there is some complaint as to the clearances being insufficient within the cab
191 as to a few specified classes of locomotives on a very limited number of railroads covered by a very few of the witnesses on behalf of the complainants, yet as to the vast majority of engines there is no evidence indicating the amount of room and clearances to be in any manner insufficient, and there is much affirmative evidence to show that the same are adequate and sufficient in all respects and that there is no occasion for the engineer placing himself, or being, in a position where he would be struck by the hand lever if for any reason it should suddenly move (5316–7, 5464, 5467–8, 5763–4, 5653, 2932 and the last 3 groups of references cited in exception no. 15, on p. 42, hereof)."

Sudden and unexpected movements of manual reverse lever are extremely infrequent and involve no danger to any engineer using ordinary care

17. That part of the proposed report appearing at lines 5 to 16, inclusive, sheet 42, referring to the evidence with respect to the hand reverse lever moving suddenly and the possibilities for injury to the engineer as a result thereof, is inaccurate and incomplete, and in order to constitute a complete and accurate summary of the evidence with respect to this subject matter should be revised to read as follows:

"Many witnesses on both sides were asked as to their experience with hand reverse gears (1) as to any cases where they had experienced the lever becoming unlatched and moving suddenly
192 (referred to as 'jumping out of quadrant' or 'going to the corner') (482–3), and (2) any cases where in handling the lever it got beyond their control (so-called 'lever getting away' from the engineer). Some of the complainants' witnesses gave a number of instances where the lever had gone to the corner; others stated they had experienced such occurrences but could recall no definite instances; and others had not experienced such occurrences at all (abst. 97–102, 5859; 122, 137, 138, 173, 175–6, 250, 256–7, 311,

322–3, 336, 347, 337–348, 358, 374, 375–7, 379, 407–8, 413–4, 415, 431, 446–447, 449–50, 475–6, 483, 492–3, 511–12, 522, 529–30, 544, 552–3, 572, 588, 600–01, 607, 609, 624, 634–44, 700, 699, 704, 737, 841, 863–64, 865, 972, 997, 1065, 1056–58, 1068, 1145).

"In most instances these witnesses gave the causes of the lever going to the corner as worn teeth in quadrant, or accumulation of oil or dirt thereon, or worn latch, weak latch spring, quadrant broken loose, and improper lubrication of the locomotive valves. All of these causes may readily be observed and checked by the engineer and the occurrence of going to the corner prevented or guarded against (261, 307–11, 175–6, 311, 572, 588, 373, 394, 699, 483–4, 522, 374–75, 379, 522). These occurrences testified to on behalf of complainants are shown in many instances to have occurred years ago and to have been infrequent on the whole, and particularly so in recent years when admittedly the railroads have greatly improved the maintenance of all parts of their locomotives, including hand reverse gears (102, 250, 256–7, 172, 175–6, 136, 311, 332–3, 336, 407–8, 413–14, 511–12, 789, 374–6, 379, 522, 482–4, 373, 394, 699, 261, 307–11, 385, 572, 482–3, 552–3).

193 "The lever will not jump out of the quadrant while the locomotive is standing (368), nor while running if the gear is in full stroke—lever in the corner (622).

"With respect to the lever 'getting away' from the engineer after he unlatches it, there was not so much testimony offered by complainants, and this is very evidently an infrequent occurrence (312–13, 737, 752, 789, 522, 572, 588, 373, 394, 699). It appears from the testimony on behalf of complainants on these two objects, first that when there is any tendency of the lever to work in an abnormal manner due to dry valves, or for any other reason, vibration of the hand lever promptly indicates this condition to the engineer without his touching the lever so that he knows just what to do in handling the lever (373, 394, 699, 483–4, 1092–3, 89–90), and second, it is the engineer's duty to attend to proper lubrication of the valves; he has the lubricator before him at all times and has the means of increasing the lubrication whenever he desires (261, 307–11, 1092–3, 86–9), and in any event the engineer is in no danger if he keeps his proper position in the cab if the lever should go to the corner or get away from him, as he simply lets it go to the corner (379, 522, 482–4, 572, 588, 483–4, 553).

"Seventy-two witnesses testified on behalf of the respondents on these subjects of the hand reverse lever 'going to the corner' and 'getting away.' Each of these witnesses had had a considerable number of years of experience operating locomotives equipped with hand reverse levers. Most of them had had many years of such experience; some of them as many as fifty years. Of these 72 had experienced the lever getting away from them at any
194 lever becoming unlatched and going to the corner. Only 5 witnesses, 21 had at some time or other experienced the hand time. The remainder of these witnesses had neither such experience

during the entire period of their engine service (abst. 102–112). Those who had experienced lever going to the corner: 1336, 1584–6, 1647, 1714, 1806–07, 1849–B, 1880–81, 1890, 1987, 2058–59, 2138, 2211, 2285, 2354, 2391, 2506–7, 2514, 2526, 2711, 3675, 3898–9, 5433–35, 3829–30. Those who experienced lever getting away: 1904–05, 2355, 3862–63, 5316–7, 5433–35. Those who had neither such experience: 1236, 1385, 1464, 1514, 1919, 2012, 2239, 2297, 2314, 2370, 2495, 2607, 2632, 2662, 2729, 2740, 2771, 2855, 2906–07, 2999–3000, 3030–31, 3040, 3058, 3099, 3108, 3120, 3170, 3311–12, 3344, 3402, 3415, 3440, 3456, 3516, 3533, 3544, 3555, 3696, 3892, 3950, 3997, 4826, 4860, 4887, 4950, 5467, 5614, 5891). In those cases where the lever became unlatched and went to full forward motion, the testimony definitely shows that such occurrences were most infrequent and for the most part occurred years ago when power on railroads was not maintained as well as it is now. (For example, see: 1584–5, 1714, 1806–7, 1849, 1880–81, 1890, 1987, 2058–59, 2138, 2211, 2285, 2354, 2526, 2711, 3829–30, 3675, 3898–99.) Where the cause was assigned, the witnesses stated such erratic action was due to worn parts, broken parts, or oil which had been put on the dog, latch or quadrant, or due to lack of proper lubrication. In none of these cases was anyone injured and the engineer, being in his proper place in the cab, experienced no danger. He very readily adopted simple measures to prevent a repetition of the occurrence (5316–17, 5464, 5467–8, 5463–4,
195 5653, 2932). With respect to hand levers getting beyond the control of engineers, the fact that only five witnesses stated they had such experience is in itself a convincing demonstration that such occurrences are rare. (See years of engine service, abst. IV–VIII.)

"When these witnesses had such experiences, they simply let go of the lever, receiving no injuries and experiencing no danger.

"Among the accidents testified to by complainants' witnesses and briefly noted above in this report, in 10 cases the lever went to the corner or got away. (See sheets 12 to 16 inclusive, proposed report, par. numbered 1, 6, 10, 11, 12, 14, 16, 18, 23, and 25.) These injuries were easily preventable by the exercise of ordinary care by the injured parties or by maintenance forces (see said par. numbered 1, 6, 10, 11, 12, 14, 16, 18, 23 and 25, as corrected by exception no. 9, hereof, see rec. 3290, 336, 348, 372, 396–7, 456, 545, 551, 760–2, 813); or by proper arrangement of air pipes or other appurtenances in the cab so as to provide adequate clearance around the lever (see said par. numbered 10, 11, 14, 16, and 25; as corrected—exception no. 9; 348, 336, 372, 456, 545, 551, 813). Seven of the remaining injuries would not have occurred had adequate clearances been provided by such simple and inexpensive means of stop blocks or pins, moving air pipes or other appurtenances further away from the lever at front end of quadrant, or cutting out a larger portion of the cab backboard. (See sheets 12 to 16, inclusive, par. numbered 15, 19, 21, 27, 40, 17; also rec. 704–5, 846, 853, 1139—43, 1165–7.) In

six cases the injuries resulted from serious breakage in machinery of the locomotive while in motion (sheets 14 to 16, inclusive,
196 par. numbered 17, 26, 28, 37, 38 and 39). It is evident that there would have been no injuries in these cases had the engineers involved used ordinary care in keeping themselves clear of the quadrant and lever by remaining in the space provided for the engineer. (See said par. numbered 37 and 39; rec. 1090, 1129–30.) These injuries were not permanent and with two exceptions were minor injuries. In one other case of breakage, the lever itself broke off due to a 60 percent defective weld, striking and very seriously injuring the engineer (994; exh. 11; abst. 54–5; see sheet 15 hereof, par 32); and in still another case the studs into the boiler head pulled out, releasing steam on the occupants of the cab and causing minor injuries, which would not have occurred if the locomotive had been equipped with a hand lever type of gear (278–9, 285; abst. 55–6; sheet 13 hereof, par 8).

"All of the remaining cases covered by complainants' witnesses were cases of strained muscles or ligaments or hernia, such as may naturally be expected to occur in the operation of any piece of machinery involving any degree of physical exertion whatsoever. (See sheets 12 to 16 hereof, par. numbered 2, 3, 4, 5, 7, 9, 13, 20, 21, 22, 24, 29, 30, 31, 33, 34, 35, and 36.) A considerable number of these cases occurred while the locomotive was standing still and a number of them were admitted by witnesses to have resulted from their failure to place themselves in a proper position before moving the lever. So far as the hernia cases are concerned, it is a matter of common knowledge that weak abdominal walls or other congenital weaknesses which permit the occurrence of a rupture in a given individual, may bring about that result at most any time during the course of
197 the individual's life. For example, stumbling, falling, or a fit of coughing may cause hernia at any time in the case of individuals having these particular weaknesses. An example of this is found in the case of complainants' witness Larson, who attributed his original strain to his foot slipping off the foot brace when he was pulling on the hand reverse lever, and who received a strangulated hernia about a year later as he stumbled and fell while having a fit of coughing as he was leaving his boarding house (746–7; 5382–3, 5408)."

Summary of accident evidence—Both types of gears

18. Lines 17 to 21, inclusive, sheet 42, are incomplete and incorrect in that they contain no summary or analysis of the accident reports and accidents referred to therein, such summary and analysis being necessary to a proper statement and understanding of the evidence in the case. Defendants suggest the following summary and analysis be included in the Commission's report in lieu of said lines 17 to 21 inclusive:

"Of the 231 accidents above mentioned, reports of which were filed under the classification "Reverse levers, operating" it appears from the form T reports that a number of power reverse gear accidents were included in these and that 8 of them referred to accidents, the facts of which were testified to by complainants' witnesses. As to the remainder of these form T reports, approximately 207 refer to accidents occurring on locomotives equipped with hand lever reverse levers and 3 occurred on locomotives equipped with hand screw reverse gears.

198 "No efforts were made by complainants to present the facts through eyewitnesses, and, therefore, there was no opportunity for cross-examination by respondents. For the purposes of this case the facts disclosed on these reports are very incomplete, unsatisfactory, and inconclusive. Several of the reports show on their face that the functioning of the hand reverse gear had nothing to do with the injury. In two cases the throttle hit the engineer (J. Gordon and Joseph W. Horn). In one case the engineman bumped his thumb on the reverse level (O. Stoneking). In another case the fireman was 'throwing the reverse gear' and caught his thumb in the back curtain (W. Humphrey). In still another case engineer was thrown against the brake lever by the impact when coupling the train (George Williams).

"A classification of these various form T reports included in exhibit 13, shows the following:

| | |
|---|---|
| A–1. Strained muscles, hernias, bruises, etc. Assigned cause—hard-working reverse lever | 27 |
| A–2. Strained muscles, hernias, bruises, etc., due to engineer placing self in awkward position when operating reverse lever, or slipping | 32 |
| A–3. Strained muscles, hernias, bruises, etc. No definite assigned cause | 39 |
| B. Injuries due to placing part of person in position to be injured | 33 |
| C. Injuries caused primarily by broken or defective parts of locomotive other than manually operated reverse gear | 9 |
| D. Striking elbows, arms, etc., against cab or other parts of locomotive | 19 |
| E. Injuries due to slipping and falling | 4 |
| 199 F. Injuries due to defective condition of reverse lever or insufficient clearance between reverse lever and some other part of locomotive | 6 |
| G. Cases in no way connected with the use or functioning of the hand reverse mechanism | 6 |
| H. Injuries due to catching part of body between reverse lever and cab | 10 |
| I. Injuries due to operation of hand screw reverse gear | 3 |
| J. Cases previously covered by testimony of complainants' witnesses | 8 |
| K. Cases covered by testimony of respondents' witnesses | 1 |
| L. Injuries where power reverse gear was involved | 11 |
| M. Miscellaneous | 23 |

"By far the greater part of these injuries were strains and bruises. All were minor injuries involving no permanent disability, with one exception. In that case four toes were amputated, causing permanent disability, and the engine was equipped with Alco type E power reverse gear (Bowers' accident). Out of the 231 accident reports included in this exhibit, only 5 show disability in excess of 60 days. Three of these occurred on engines equipped with hand reverse gears and two with power reverse gears. The facts, so far as shown by these form T reports, were as follows:

"In the 3 hand reverse gear cases

"Hickey—Hernia, 70 days.

"Moseley—Potts fracture, 90 days. (Evidently placed foot on boiler head in front of lever.)

200 "Afford—Compound fracture of leg, 90 days. Caused by drawbar falling out of car and catching link on engine.

In the 2 power reverse cases

"Blowers—4 toes amputated, permanent injury. Alco power reverse gear.

"Ryan—wrist fractured, 61 days. Franklin precision type F power reverse gear gave quick and unexpected turn of reverse wheel.

"Indicating the minor character of these injuries, we find 133 of them involving disability of from 4 to 15 days; 52 from 16 to 30 days; and only 25 from 31 to 60 days.

"Counsels' statements of record indicate that they included in this exhibit 13, form T reports with respect to all accidents occurring with manually operated reverse gears for the years 1929 and 1930 (1185–94, 4932–9). Considering the many millions of locomotive miles operated during those years, it is a strong testimonial for the safety of hand reverse gears that no enginemen, of the many thousands operating throughout those years in the United States, received any permanent injury in connection with operating hand reverse gears; that all of the injuries suffered were of a decidedly minor character and only a very few of them caused more than one month's loss of time. We doubt if any equal amount of operation of a simple piece of machinery in any other line of industry would show as good a record. This is a testimonial alike to the mechanism itself, and to the railway managements and men who have stressed the observance of ordinary care at all times by employees (5405, 5754–6, 5466–7, 5537–5540). In this connection it is interesting to observe that many of these minor injuries for the years 1929
201 and 1930 very apparently, on the face of them, would have been avoided by the use of ordinary care. It is indeed a significant fact that the only permanent injury shown by complainants' exhibit 13 was caused by power reverse gear. This exhibit does not show that any of the locomotives involved in these accidents were maintained and used by the defendants in a manner which did not permit of their operation 'without unnecessary peril to life or limb.' Neither do these accidents establish that all of the locomotives now ants' witnesses show that the locomotives involved were, because equipped with manually operated reverse gears, not in proper condition and safe to operate without unnecessary peril to life or limb. Neither do thees accidents establish that all of the locomotives now owned and maintained by defendants and equipped with manually

operated reverse gears, are, by reason of that fact, not in proper condition and safe to operate without unnecessary peril to life or limb.

"The personal injuries and deaths occurring in accidents with power reverse gears, concerning which testimony was presented by respondents' witnesses, may be roughly divided into the following classes (abst. 135–167):

"(a) Accidents resulting in injuries to enginemen while operating the lever or wheel of the power reverse gear due to the lever kicking (1516–7, 1525, 2633, 5616–7; ex. 89; Chadwick), or the wheel spinning, kicking, or working hard (3031, 3032, 3676–7, 5960, 5965).

"(b) Accidents due to engines crashing into roundhouse walls or into turntable pits. In some instances, the engine moved because of a leaky throttle, or because of the manipulation of the throttle when there was insufficient air to stop the engine
202 (1933–7, 2396–9, 2400–1, 2402–4, 2852). In other instances the operating lever of the power reverse gear was set to move the engine in one direction while the valve gear itself was in such a position as to cause the engine to move in the opposite direction. Such variances between the position of the lever and that of the reverse gear mechanism occurred because of insufficient air pressure in the air supply to the reverse gear cylinder or because of creeping of the power revese gear. (A few examples: 2335–44, 2778, 3709–10, 3972–3, 4958–9.) In the case first cited a boiler maker who happened to be between the engine and the roundhouse wall was crushed and killed (abst. 140).

"These accidents would not have happened with locomotives equipped with hand reverse gears because, in the first class of cases, as was shown, the manually operated reverse gear can be and is customarily used for braking purposes; the reversing of the engine, and opposing steam pressure to the piston heads in the locomotive cylinders furnishes braking power and the action of the hand reverses gear is not dependent upon the presence of air to enable it to function. Hence it can be used (in the absence of air pressure) as a substitute for the brakes; but the air reverse cannot because it is dependent upon the same air pressure. The prevalence of this emergency use of the hand reverse gear to control locomotives without brakes and prevent accidents is shown by the testimony of many witnesses on both sides of this case. A reference to but a few witnesses will suffice. (Thorpe, 1996; Buckner, 2516–17—averted collision with passenger train; Moore, 6263; McHugh, 6068–9; Hayes, 5442–7; Welch, 2323–4, 2330—averted head-on collision with
203 passenger train; Proebstle, 2067–75—averted one collision between switch engine and one between a switch engine and a passenger train.) An engine equipped with a power reverse gear moved of its own volition 150 feet, running into a shop where men were at work, killing one man and seriously injuring two. Had it been equipped with a hand reverse gear it could readily have been

controlled by Traveling Fireman Wallace who was in the cab at the time, and the accident entirely averted (2848–52; abst. 146; exh. 36). In the second class of cases the position of the hand reverse lever in the quadrant positively indicates the position of the valve gear and, therefore, indicates the direction in which the locomotive will move. In the event steam leaks or is admitted into the cylinders the reverse gear cannot creep when held by the positive and direct connection of the valve mechanism with the hand reverse lever (5473).

" (c) Accidents resulting in injuries due to the valve gear moving without warning when the air is being pumped up or because of creeping of the gear or other defect of a power reverse gear. It is well known that enginemen, mechanics, and other shopmen have frequent occasions to work around the various mechanical parts of the locomotives. Whenever the valve gear moves in such fashion, manifestly, there is an element of danger. That such erratic movements of the gear mechanism have resulted in numerous and severe injuries is forcibly demonstrated by the testimony in the record (1527–30, 2217–8, 2305–8, 2670–2, 2665–8, 2694–5, 2820–6, 2879–82, 2968–71, 2975, 5969–79). In the case cited last an engineer was severely injured (and later died) because a creeping power reverse gear caused a locomotive to move of its own volition
204 while he was attempting to remove a broken brake-beam beneath the tender.

" Obviously, these accidents could not occur with a locomotive equipped with a hand reverse gear, because no air is present to move such mechanism.

"(d) Accidents resulting in injuries to employes working around locomotives, due to the movement of the operating lever of the power reverse gear by another employe. Twenty-three such accidents are shown in this record—see cases marked "(b)"—(1392–96, 1558–9, 1877–78, 2199–2200, 2213, 2215–17, 2542–50, 2634, 2673–77, 2748–54, 3978–80, 4826–37, 4893–4900, 4838–39, 4842–43, 4945, 4969, 5105–5107, 5990–5996; 5617–18; obst. 135–167). It will be noted that in five of these cases the overpowering force of the power reverse gear crushed out the lives of the unfortunate victims. In three of these cases heads were crushed (Boggs—Witnesses Crystal and Von Bergen, abst. 137, 161; Bunnell—Witnesses Stearns, Burnett, abst. 152, 154; Abbott—Witness Kiely, abst. 158); one was caught by the neck and virtually hanged (Garrett—Witness Wells, abst. 145–6, and one was crushed through the body (Nomoto—Witness Canady, abst. 156).

" This type of accident appears much less likely to occur if an engine is equipped with a hand reverse gear. In the few cases where it has happened the resulting injuries have been comparatively minor in character. It is very significant that the record discloses only three instances where such accidents have happened with hand reverse gears (2835–9, 5153–5, 6434–5). The injuries received in each

of these cases were light. In the first instance the engineer was cut about the temple and face but lost no time. The evidence
205 leaves no doubt that this man would have been seriously injured and in all probability killed had this engine been equipped with power reverse gear. In the second instance an employe had his toes caught under the reach rod but went right on back to work. In this case the greater force of the power reverse would have mashed or broken his toes. And in the third case the fireman had a bone in his little finger broken, losing three weeks' time. In this last case, the result would have been the same with either gear as the little finger was pinched against the gear frame at the end of the movement and there was no obstruction during the movement of the lever.

"This difference in potentiality for causing serious injury is clearly seen when these three cases are contrasted with like accidents with power reverse gears, where the injuries were much more serious and several resulted in deaths as mentioned above (2305–8, 2534–6, 2820–6, 2835–9, 2974, 4885, 5091–5, 5105–7, 5203–5, 5209–15, 5210–19, 5228–30, 5254–5).

"The explanation of this difference lies in the differing characteristics of the two devices. The power reverse gear level must be moved first before the air is admitted to the air cylinder which causes the reverse gear to be moved and the movement of the valve gear parts does not begin immediately with the movement of the operating lever. When, however, the operating lever of the power reverse gear is moved a certain distance the full force of the air pressure is exerted upon the valve gear parts and the movement of such parts cannot be stopped by a subsequent change in the direction of the lever until the gear parts have moved to the point corresponding to the position where the lever was stopped. With a hand
206 reverse lever the engineer has the extent, speed, and force of the operation under his control at all times. In addition, the force of the air in the power reverse is substantially greater than that of the force behind the hand reverse lever and, lastly, the operator of the hand reverse gear can feel an obstruction in the reverse gear mechanism, whereas the operator of the power reverse gear cannot (1865, abst. 137; 2975, abst. 147; 4951–7, abst. 154; 5225, abst. 159; 5231, 5460, 5473–4, 5739–41, 5820–2, 4861–78, abst. 152–3; 2290–2, 2416–7, abst. 139; 2537–8, abst. 142; 2700, abst. 145; 5146–53, 5156, abst. 156; 5191–4, abst. 157; 5228–31, abst. 159–60).

"(e) Accidents resulting in breakage of valve gear parts, locomotive failures and delays due to improper functioning of the power reverse gear.

"A number of respondents' witnesses testified as to various accidents due to creeping which resulted in broken valve parts, locomotive failure, delays and personal injuries (1558, 2673–7, 3978–80, 3999, 5110–12, 2308, 5617–18). Inasmuch as the record demonstrates that hand reverse gears do not creep, accidents due to such causes with hand reverse gears are impossible.

"(f) Accidents resulting from runaway engines due to the failure of the air supply.

"The inability of engineers to control engines due to the failure of the air supply while operating over the road was described by several of the witnesses. The most serious of these accidents occurred on descending grades with locomotives running light, namely, without cars being coupled to the locomotive.

"In one case the fireman was killed, the engineer badly
207 injured, the locomotive and right of way were damaged to the extent of $2,800, and collision with a passenger train on a dangerous mountain grade was averted only by the greatest good fortune. All would have been prevented with a hand reverse gear which could have been used as an emergency brake (Dalzell case, 4826–37, 4838–39, 4842–43, 4945; abst. 151–2). In a second case, under similar circumstances, three men were hurt—one very seriously—with property damage of $4,488 (Mote case, abst. 166–67, exh. 103). In Bailey's case he and others miraculously escaped injury but there was damage to equipment amounting to $2,885. Under similar circumstances Cooksey was injured severely, two others less severely and property damage to the extent of $17,500 occurred (3317–28, ex. 40 and 90, 3329–30, 3331–32, 3320; abst. 148–9). Aita had a less serious smash-up fraught nevertheless with very dangerous possibilities (2748–54; abst. 145). And, as mentioned above, one man was killed and two very seriously injured in the Wallace case (2848–52; abst. 146, exh. 36). All could have been avoided had these engines been equipped with hand reverse gears."

Engineers can avoid injury in case manual reverse gears move suddenly and unexpectedly

19. The two sentences of the proposed report beginning in line 26, sheet 42, and ending with line 5, sheet 43, with regard to the engineer's ability to avoid injury in case of unexpected movement of hand reverse gears should be eliminated as same are entirely unsupported and unwarranted by the evidence, and the following should be substituted therefor:

208 "The admissions of some of complainants' witnesses in a number of cases (456, 761–2, 1090, 1129–30); see exception no. 9 hereof, and the obvious and undisputed facts in many other cases put forth on behalf of complainants indicate that most such cases are preventable by the use of ordinary care on the part of the engineer. This is further established and well exemplified by affirmative testimony of numerous witnesses, detailing their experience in handling manually-operated reverse gears without danger, inconvenience, or injury to themselves or to others over long periods of service (Thorpe 51 years of service, 1982–2007; Hall 42 years, 5463–4; VonBergen 30 years, 5304–5, 5315–17; Kerby 51 years, 5896–5908; Ford 36 years, 5889–5895; Buell 44 years, 1886, 1889; Bobbitt 39

years, 3945–7; Crowley 41 years, 1844–1846; Cherry 31 years, 5243; Cosper, 24 years, 3550–55, 3571–2, 3585–87; Gorman 30 years, 5735–7; Harris 43 years, 3340–1, 3344; Jeffers 35 years, 2388–90; Landers 33 years, 3889–91; Murphy 44 years, 2973, 2977–8, 2984–5; Rowe 36 years, 3166–70; Stearns 28 years, 4857–9; Truman 58 years, 2966–70; Welsh 43 years, 2321, 2327–8; Wood 30 years, 3789–91, and many others). 125 witnesses testified on behalf of respondents with an aggregate of 3,842 years of engine service, principally as engineers, and in some instances in later years in supervisory capacities such as road foreman of engines, fuel supervisors, etc., each of whom had had a large amount of experience operating engines equipped with manually operated reverse gears, and with four exceptions none of these witnesses had been injured or had observed anyone else being injured with manually-operated reverse gears. These four injuries were trivial in each instance and caused no loss of time
209 (2136; 2144; 2239–40; 2835–39; 2845–6; 5153–6; abst. 61–3; see complete list of respondents, witness citing pages of record including years of service and indicating only cases in which accidents with hand reverse gear had occurred, abst. IV–VIII). The record further shows that accidents to engineers while operating hand reverse gears, along with all other classes of accidents on the railroads, have been reduced by intensive safety work which has been carried on during recent years (Warfel 4427–34; exh. 53; 5405, 5754–6, 5466–7, 5537–40)."

Accidents with manual gear show they are preventable by means other than installing power reverse. Frequency of reverse lever adjustment

20. The two paragraphs included in lines 6 to 22, inclusive, sheet 43, as to causes of accidents and frequency of movement of manual reverse gears, inaccurately and incompletely refer to the evidence in the case and state an erroneous conclusion of fact. Said paragraphs should be revised to read as follows:

"Complainants rely principally upon the evidence produced by them of cases where injuries have occurred to engineers due to breakage of parts, of the valves or valve gear, lack of lubrication, the presence of steam in the cylinders, and snow or ice on the valve gear. 6 cases of such breakages are shown by the testimony of complainants' witnesses and 9 such cases appear in exhibit 13. With the possible exception of one case where the lever broke off (due to a 60 percent defective weld), evidently striking the engineer, there
210 would have been no injury in any of these cases if the engineer had exercised that degree of care and skill which may reasonably be expected of a trained employee. If the doctrine of "safety first" as promulgated and practiced by the managements and their employees alike, by means of safety meetings, circulars, etc. (4427–34, 5405, 5754–6, 5466–7, 5537–40, et al.) were thought to be insufficient to counteract careless tendencies on the part of engi-

neers and any unnecessary danger could be discerned in operating hand reverse gears as they now are, it can hardly be doubted that the men would long before this have requested guards to be installed about the reverse lever. That the railroad managements would have been quick to comply with such requests, or would have taken the initiative in such installation if the men or the managements discerned any danger in the existing devices, cannot be doubted in view of the progress made in safety matters in recent years. The record shows no such requests; nor are the complainants here making such request, although it is a self-evident physical fact that such guards could cheaply and effectively be installed and the testimony affirmatively shows this (167–9, 456–9, 963, 713, 1156, 484–5, 163–4, 546–51, 3001–3, 385, 572). Lack of lubrication and steam in the cylinders are easily counteracted and eliminated by the engineer before attempting to move the lever (86–9, 261, 307–11, 1092–3, 1022, 1158–61, 107–8, 124–5). Trouble from snow, ice or cold weather is easily eliminated by the use of kerosene even in the Rocky Mountain regions, where extreme cold weather and long winters prevail (3145–6; 2714–15; and several others). There appears to be fully as much trouble experienced in freezing with power reverse gear as
211 with hand reverse gear (1253, 1522, 1620–1, 1928–9, 2064–6, 2132–5, 2375–6, 2537–8, 2669, 2684, 3138–43, and numerous other instances cited; Ast. 70–97, cases (f)), and improper lubrication is not as readily discoverable with power reverse gear as with hand reverse gear, thus impairing the engineer's ability to quickly rectify such condition and therefore making serious damage to the locomotive and breakage of its machinery an additional possibility with power reverse gear (5795, 373, 394, 699, 1093–4, 2186–7).

"In actual operation the reverse gear may be moved frequently, the frequency varying with different classes of service. The most frequent movement of the reverse lever occurs in what is known as flat or short switching service, where it was estimated by complainants' witnesses that at times of greatest activity the lever may be moved at the rate of from 20 to 60 times an hour during a part of the day's work. (Stackey, 208–9, Rudolph, 701–2; Pool, 1064; Walker, 1106.) In this service the lever is usually moved from one end of the quadrant to the other—i. e., the engine is reversed. This operation is always done while the engine is standing still (226–8). In road service the movements are less frequent and may involve but 3 or 4 adjustments of the lever in the course of an hour, or even less in through passenger service where few stops are made, with a somewhat greater number of adjustments in local passenger or freight service (5384–5.) There is no danger or likelihood of injury to the engineer while making such adjustments of the manually operated reverse gear, nor while reversing his engine, if he himself will use only an ordinary degree of care in handling the gear, that is to say the same degree of care that is customarily exercised by
211 any workmen in using the tools of his trade; and in cases where there is lack of lubrication, steam in the cylinders, snow

or ice on the valve gear, or other condition existing which he knows will have some effect upon the operation of the reversing gear, if he will exercise only such ordinary degree of care as is mentioned above he will be subjected to no liability of injury whatsoever. (See references to record, pp. 42 and 44, hereof.)"

Power reverse gears were neither developed nor applied to promote safety nor have they done so

21. The paragraph included in lines 23 to 31 sheet 43 is an incorrect and incomplete statement of the facts shown of record, fails to give effect to the positive and uncontradicted testimony of defendants' witnesses showing why power reverse gears now in use have been applied and the result thereof as regards accidents, and should be revised to read as follows:

"Defendant carriers have shown by evidence which is uncontradicted that the equipment of locomotives with power reverse gears does not eliminate accidents, and that power reverse gears have not been applied with any thought or purpose on the part of the carriers of promoting safety. There is no evidence that the manufacturers of power reverse gears have ever claimed or contended that the application of such equipment to locomotives would promote safety in any way, and there is affirmative evidence in the record showing that they have not made any such claims (5468, et
211 al.), which evidence is confirmed by the fact that representatives of the three principal manufacturers of power reverse gears were called and testified as witnesses on behalf of complainants, explaining the construction, characteristics and purposes of their respective devices, and their testimony contains nothing indicating that the purpose or claims of these manufacturers involved promotion of safety in any way (6349–77, 6377–92, 6392–9). The uncontradicted evidence submitted by the carriers shows that the application of power reverse gears has been due to the increasing width of the fire box and boiler head on modern locomotives of the larger types built within recent years, together with the necessity of placing an increasing number of appurtenances and controls within reach of the engineer in the cab. Because of impossibility to build the cabs wider or longer, on account of outside clearance limits, this has resulted in greatly reducing the available space within the cab on the engineer's side, and from the standpoint of design has made it mechanically awkward and impracticable to design mechanically operated reverse gears for these locomotives (5643–4, 5906, 5662, 5500, 5576, 5579, 5583, 5785, 5700–1, 5706–7, 5802–11, 5818, 5798–5802). Because of the smaller operating lever and quadrant, or operating wheel of the power reverse gear, it has been found readily adaptable to these new conditions on the modern power by the designers thereof, and has been used in preference to the manually operated types of reverse gear for that reason (5643–4, 5798, 5906, and references last above cited). Aside from the above con-

siderations the evidence submitted by all parties in this proceeding is to the effect that the matter of size of locomotives, or their
212 weight on the drivers, or otherwise, has nothing whatsoever to do with the question as to whether a manually operated or a power operated reverse gear should be used thereon (4749, 5855–70, 4191, 5311–13, 1892, 3414, 2927, and references on p. 5, hereof). The carriers have established by evidence consisting of illustrative types of accidents, and supported by opinions of mechanical men and engineers of long service, that in several respects there is greater likelihood of accident and more possibility of personal injury in operating locomotives equipped with power reverse gears than those equipped with hand reverse gears, and they have further shown that the results of accidents and injuries resulting in connection with the operation of power reverse gear equipment have frequently been much more serious and have caused several deaths, which has not been the case in connection with operation of locomotives equipped with manually operated reverse gears (1516–7, 1525, 2633, 5616–7, exh. 89, 3031, 3032, 3676–7, 5960, 5965, 1993–7, 2396–9, 2400–1, 2402–4, 2852, 2335–44, 2778, 3709–10, 3972–3, 4958–9, 2335–44, Thorpe, 1996; Buckner, 2516–17; Moore, 6263; McHugh, 6068–9; Hayes, 5442–7; Welch, 2323–4, 2330; Proebstle, 2067–74; 2848–52; abst. 146, ex. 36, 5473, 1527–30, 2217–18, 2305–8, 2670–2, 2665–8, 2694–5, 2820–6, 2879–82, 2968–71, 2975, 5969–79, abst. 135–167; Crystal and Von Bergen, abst. 137, 161; Stearns, Burnett, abst. 152, 154; Kiely, abst. 158; Wells, abst. 145–6; Canady, abst. 156; 2835–9, 5153–5, 6434–5, 2305–8, 2534–6, 2820–6, 2835–9, 2974, 4885, 5091–5, 5105–7, 5203–5, 5209–15, 5216–19, 5228–30, 5254–5, 5315, 1865, abst. 137; 2975, abst. 147; 4951–7 abst. 154; 5225, abst. 159; 5231, 5460, 5473–4, 5739–41, 5820–2, 4861–78, abst. 152–3; 2290–2, 2416–17, abst. 139; 2537–8, abst. 142;
213 2700, abst. 145; 5146–53, 5156, abst. 156; 5191–4, abst. 157; 5228–31, abst. 159–60; 1558, 2673–7, 3978–80, 3999, 5110–12, 2308, 5617–18; 4826–37, 5838–39, 4842–43, 4945, abst. 151–52; 5990–5996, abst. 166–67, exh. 103; 3317–28, exh. 40 and 90, abst. 148–49; 2748–54, abst. 145; 2848–52, abst. 146, exh. 36; 1321–2, 1402, 1476, 1595, 1622–3, 1655, 1713, 1815, 1936, 1998, 2030, 2078, 2105, 2250, 2095, 2377, 2446, 2557, 2615–16, 2677, 2703, 2754–5, 2857, 3068, 3105, 3150, 3283–4, 3422, 3519, 3533, 3545, 3570, 3698, 3772, 3797, 3877, 4003, 4901, 4971, 5159, 5326–7, 5061, 5674, 5818, abst. 127–135)."

Manual reverse gears operate regardless of lack of air pressure on engine

22. In order to bring out the significance of the paragraph of the proposed report ending with line 26, sheet 44, the following sentence should be added:

"Manually operated reverse gears are not dependent upon air pressure for operation and these classes of accidents do not occur with such gears (Olson, 2219; Shockley, 2335–44; Burkhalter, 2670–72; Holmquist, 2807; Beach, 2774–78; Watt, 2609–15; Wallace, 2848–51;

Wilkins, 2880–1; Murphy, 2974–5; Baker, 3969–70; Burnett, 4958–59; Rector, 5191–4; Hayes, 5436–8; Hall, 5472–4; Lambright, 5969–77)."

Auxiliary steam supply is inadequate to meet certain emergencies and is unsatisfactory

23. The sentence beginning near the end of line 1 and ending with line 4 sheet 45, is an incorrect and incomplete statement of
214 the facts regarding steam connections on power reverse gears and should be revised to read as follows:

"On many locomotives equipped with power reverse gears an auxiliary steam pipe connection to the power reverse cylinder is installed so that in the event of a failure of the air supply, which renders the power reverse gear inoperative, it will then be possible by opening two steam valves to admit steam to the power reverse cylinder instead of air and by means of that connection place the power gear in operation. Whenever steam is used in this manner to operate the gear it becomes necessary thereafter to entirely renew the packing cups in the power reverse cylinder as the steam destroys the packing and lubrication, and the gear will not again work properly until thus repaired (2748–54; 5560–4; 1769–70; 5139–41). Moisture gets into the power reverse cylinders in cold weather, the gear will freeze up and become inoperative (4963–6, 4973–4). For these reasons the two valves in the auxiliary steam pipe are used but still do not eliminate the difficulty. Since the auxiliary steam pipe is connected to the air supply pipe leading to the power reverse cylinder at or near such cylinder, in cases where this connection is broken off, at or near the cylinder, the steam supply cannot then be made available to again place the gear in operation. A number of cases of this kind, as well as cases of absolute failure of the power reverse gear to function on account of freezing or breakage or misadjustments of some part or parts of the power reverse mechanism itself, are shown of record (1522, 1620–2, 2064–6, 2132–5, 2132–5, 2375–6, 2537–8, 2669, 2684, 3138–43, and a great many other cases cited in Abst. 71–97, designated (d), (e), and (f). Because of the difficulties
215 encountered on account of this auxiliary steam connection at least one large railroad has discontinued same (1769–71)."

Corrosion interferes with use of emergency steam connection

24. The sentence included in lines 5 to 7, inclusive, sheet 45, is incomplete in that it fails to state certain important elements appearing without contradiction in the evidence showing the inefficiency and inadequacy of auxiliary steam connections in cases of emergency. The following should be inserted at the end of said sentence:

"A considerable amount of corrosion normally builds up on these valves which of necessity are moved or manipulated infrequently, which makes it difficult and sometimes impossible to operate them so as to cut in the auxiliary steam supply quickly in an emergency (Bailey, 4885–4915; Burnett, 4963–6, 4973–4)."

Accidents illustrating inefficiency of auxiliary steam supply in emergencies

25. In order to complete the summarization of evidence with respect to cases where the auxiliary steam supply was found inadequate to prevent accidents on failure of the power reverse gear to function because of loss of air supply, the following should be added to the paragraph which ends at line 16, sheet 45:

"In this case the engine proceeded down a steep mountain
216 grade at an exceedingly high rate of speed and ran into some steel gondola cars at the next station, wrecking them and damaging the engine. It was only by the greatest good fortune that the engineer was able to leave the engine at high speed without serious injury and that no injuries or deaths resulted at the point of collision (4893–4900, 4969). In the previous case there was enough air pressure remaining to reverse the engine and after doing that and working steam against the movement of the engine, the engineer succeeded in bringing it down to a speed of 3 or 4 miles an hour, when the decreasing air pressure permitted the reverse gear to move into forward motion again causing the engine to move forward, rapidly gain speed on a descending grade, leaving and damaging the track at a point of curvature, killing the fireman and seriously injuring the engineer. This engine was closely following a limited passenger train and had it not left the rails would undoubtedly have crashed into the rear of that train. It was followed by a second section of the same passenger train, which would undoubtedly have left the track at the point of accident had not the engineer regained consciousness and found sufficient strength to go back up the track and flag this second section (4826–37, 4945). This accident undoubtedly would have been avoided had the engine been equipped with a manually operated reverse gear (4838).

"In another case where the air supply on the locomotive escaped, due to breakage, on a descending grade, and the power reverse gear became inoperative the engineer and fireman stayed on the locomotive and worked as long as they dared in trying to get the auxiliary
217 steam supply cut in, but were unable to do so prior to reaching a meeting point with a stock train. The engineer was seriously injured and the fireman less seriously injured in leaving the locomotive, which proceeded at high speed head on into the stock train. Both locomotives were severely damaged, the engineer on the other train was slightly injured and a large number of sheep killed and injured as a result of this collision, which in all probability would have been averted had the engine been equipped with a manually operated reverse gear, as that would have permitted of the reversing of the engine and the retarding of its movement by working steam in the cylinder against the movement of the engine (Cooksey 3317–28, exh. 40 and 90, 3320, 3329–30).

"In still another case under quite similar circumstances the engineer endeavored to reverse his engine with the power reverse gear but found the air supply insufficient and although he had in the neighborhood of a mile of a run before reaching the side track, the time was insufficient to permit of his cutting in the auxiliary steam connection, and thus being unable to reverse and control his engine it ran on into the siding and collided with the remainder of his train, to which he was returning, causing considerable property damage and very severe injuries to the fireman with less severe injuries to the engineer and brakeman (Mote, 5990–6).

"In a further case, not on a descending grade, the steam supply pipe to the air pump broke while the engine was standing still, thus giving the engineer ample opportunity to cut in and use the auxiliary steam supply to the power reverse gear before the air entirely leaked off. Soon thereafter in endeavoring to move the gear it failed to function because the steam had destroyed the packing in the
218 gear, resulting in a collision at slow speed, causing considerable property damage but fortunately no personal injuries; all of which would not have occurred had the engine been equipped with manually operated reverse gear (2748–54).

"These cases show that the auxiliary steam supply cannot always be relied upon to restore the function of the power reverse gear in the event of air failure, and that in cases of emergency where it is necessary to use the reversing gear for braking purposes it is oftentimes impossible to restore the function of the gear by means of the auxiliary steam supply in time to prevent the accident."

Manually operated reverse gears are efficient to control locomotive and prevent accidents in cases of insufficient air pressure to operate brakes

26. The paragraph included in lines 17 to 25 inclusive, sheet 45, is inaccurate and fails to give effect to the uncontradicted testimony regarding ability to control locomotives in absence of available air pressure by using the manually operated reverse gear for braking purposes. This paragraph should be revised to read as follows:

"In many instances, due to one cause or another, locomotives have unexpectedly moved when no air pressure was available with which to operate the air brakes. Under such circumstances it is possible in most cases to immediately stop or control the locomotive (if equipped with manually operated reverse gear) by reversing the engine and admitting steam to the cylinders. By so doing the
219 pressure of the steam in the cylinders is applied against the movement of the piston heads, thus retarding the movement of the driving wheels and acting as a brake (1996, 2516–17, 6263, 6068–9, 5442–7, 2323–4, 2330, 2067–74, 3103–4, Abst. 83–4).

"The evidence shows a great many experiences of engineers (both witnesses for complainants and defendants) who have successfully controlled locomotives equipped with hand reverse gears by using

the reverse gears in this way for braking purposes. This evidence includes not only cases where the locomotive moved unexpectedly without air pressure, but a number of other cases where in emergencies engineers by quickly reversing their engine were able to avert collisions in circumstances where they would have been unable to do so had the locomotive been equipped with power reverse gears. In both classes of cases a number of serious accidents, including collisions with passenger trains, are shown by the evidence to have been averted in this manner, which could not have been avoided with power reverse gears (Thorpe, 1996; Buckner, 2516–17—averted collision with passenger train; Moore, 6263; McHugh, 6068–9; Hayes, 5442–7; Welch, 2323–4, 2330—averted head-on collsion with passenger train; Proebstle 2067–74—averted one collision between switch engine and one between a switch engine and a passenger train; and many other cases).

220 Power reverse gear injuries shown to be more numerous and serious where men get caught on intended movement of gears

27. Paragraph beginning at line 26, sheet 45, and ending with line 3, sheet 46, referring to that class of accidents where serious and fatal injuries have resulted from employees being caught between some portion of the valve gear and other parts of the locomotive upon movement of the power reverse gear, is incomplete and incomprehensive of the evidence in the case, and in order to summarize the relevant evidence on this subject matter should be amplified by adding the following thereto:

"Twenty-three such accidents are shown in this record (see cases marked '(b)' abst., 135–167;—1527–30, 2217–19, 2288–89, 2414–15, 2290–2, 2416–17, 2520, 2537–8, 2535, 2670–72, 2694–95, 2700, 2820–26, 2880–1, 2989–71, 2974–5, 3253–56, 3469–71, 3758–60, 3893–95, 4861–78, 4885, 4945, 4951–57, 5091–95, 5146–53, 5156, 5158–59, 5191–94, 5203–05, 5206–08, 5209–15, 5222–25, 5228–31, 5739–41, 5742, 5969–77, 5979, exh. 101). It will be noted that in five of these cases the overpowering force of the power reverse gear crushed out the lives of the unfortunate victims. In three of these cases heads were crushed (Boggs—Witnesses Crystal, 1857–63, 1865–66, 1868–69, abst. 137–38; and Von Bergen, 5820–22, abst. 161; Bunnell—Witnesses Stearns; 4885, 4861–78, 4945, abst. 152–53; and Burnett, 4951–57, abst. 154; Abbott—Witness Keily, 5209–15, abst. 158) and one was caught by the neck and virtually hanged (Garrett—Witness Wells, 2820–
221 26, abst. 145–6), and one was crushed through the body (Nomoto—Witness Canady, 5146–53, 5156, abst. 156–7).

"This type of accident is shown to be much less likely to occur if an engine is equipped with a hand reverse gear. In the few cases where men have been so injured by the intended movement of hand reverse gears, the injuries have been comparatively minor in character. It is very significant that the record discloses only three instances where such accidents have happened with hand reverse gears

(2835–9, 5153–5, 6434–5). The injuries received in each of these cases were light. In the first instance the engineer was cut about the temple and face but lost no time. The evidence leaves no doubt that this man would have been seriously injured and in all probability killed had this engine been equipped with power reverse gear. In the second instance an employee had his toes caught under the reach rod but went right on back to work. In this case the greater force of the power reverse would have mashed or broken his toes. And in the third case the fireman had a bone in his little finger broken, losing three weeks' time. In this last case, the result would have been the same with either gear as the little finger was pinched against the gear frame at the end of the movement and there was no obstruction during the movement of the lever.

"This difference in potentiality for causing serious injury is clearly seen when these three cases are contrasted with like accidents with power reverse gears, where the injuries were much more serious and several resulted in deaths as mentioned above (2305–8, 2534–6, 2820–6, 2835–9, 2974, 4885, 5091–5, 5105–7, 5203–5, 5209–15, 5216–19, 5228–30, 5254–5).

222 "The explanation of this difference lies in the differing characteristics of the two devices. The power reverse gear lever must be moved first before the air is admitted to the air cylinder which causes the reverse gear to be moved and the movement of the valve gear parts does not begin immediately with the movement of the operating lever. When, however, the operating lever of the power reverse gear is moved a certain distance the full force of the air pressure is exerted upon the power reverse piston and transmitted to the valve gear parts and the movement of those parts cannot be stopped by a subsequent change in the direction of the lever until the gear parts have moved to the point corresponding to the position where the lever was stopped. With a hand reverse lever the engineer has the extent, speed, and force of the operation under his control at all times. In addition, the force of the air in the power reverse is substantially greater than that of the force behind the hand reverse lever and, lastly, the operator of the hand reverse gear can feel an obstruction in the reverse gear mechanism, whereas the operator of the power reverse gear cannot (1865, abst. 137; 2975, abst. 147; 4951–7, abst. 154; 5225, abst. 159; 5231, 5460, 5473–4. 5739–41, 5820–2, 4861–78, abst. 152–3; 2290–2, 2416–17, abst. 139; 2537–8, abst. 142; 2700, abst. 145; 5146–53, 5156, abst. 156; 5191–4, abst. 157; 5228–31, abst. 159–160)."

Complainants' claim that there is no liability of injury to engineer in cab with power reverse gear is disproven

28. The sentence appearing in lines 4, 5, and 6, sheet 46, on the subject of the claim made by complainants that there is no
223 liability of injury to the engineer in cab due to action of the reverse gear on locomotives equipped with power reverse gears,

is incomplete in that it fails to state the undisputed facts of record in this case with respect to such claim. In order to state what the proof shows regarding such claim, the following should be added thereto:

"The contrary is proven by the evidence in this case which shows a number of injuries sustained by enginemen in the cab due to power reverse gear levers, or wheels, kicking, spinning, or working hard (Chadwick, 5616–7, exh. 89; Ryan, 3031–2; Dickhaut, 3676–7; Emsworth, 5965–6; Harris, 5959–61; Brotherton, 1516–17, 1525, 1558–9; Fraley, 1387–9; Burkhalter, 2668–9; Slosson, 3062–4; Coyle, 3104–5, 3102–3; Colache, 3252; Maloney, 5616–7); and numerous other accidents involving engineers in the cab operating power reverse gears where injury did not happen to result (Olsen, 2213, 2215–17; Williams, 2555–6, 2542–50; Bates, 2633; Summers, 2243–5; Herrick, 2014–21; Ellis, 2128–9; Ward, 1811, 1833; Freeland, 1690–1703; Richter, 1921–2; Brotherton, 1523–4; Hintz, 2357–9; Jeffers, 2392; Knight, 2892; Tewksbury, 2936; Tesch, 3010–11; Love, 3041–2; Coyle, 3100–4; Rowe, 3171–2; O'Neil, 3194–5; Ingram, 3209–11; Schaller, 3222–5; Cooksey, 3315; Harris, 3350; Cooper, 3446; McPhail, 3756–7; Jones, 3873–5; Pulliam, 3769–71; Fitzgerald, 3853–4)."

224 Use of manually operated reverse gears has not interfered with engineers keeping lookout or observing signals; safety not affected; complainants contention not sustained

29. The two sentences beginning in line 6 and ending with line 13, sheet 46, with respect to the subject matter of ability to observe signals and the effect thereof upon safety with the two types of reverse gears, is incomplete in that it does not state what is proved by the evidence in the case on this subject matter. The following statement of the evidence should be added to these two sentences:

"Eighteen witnesses who testified on complainants' behalf on this subject confined their testimony largely to switching service or when engaged in reversing engines with manually operated reverse gear (Stone, 67, 112–13, 77; Hunt, 135–36, 139, 146–47; Greenwood, 177; Stuckey, 203; Irwin, 225–30, 236; Hurd, 276–77; Snoddy, 435–6; Stakeman, 546; Austin, 629; Williams 651; Rudolph, 700, 702, 715; Stringer, 759; Adams, 790; Crum, 872; Barton, 931–32, 923; Kinnaird, 973; Walker, 1107; Brandt, 1153–54; abst. 31–34).

"Only five of the above-mentioned witnesses testified with respect to road operation. One said it is possible to keep a lookout only a short distance ahead while hooking up or dropping down the reverse lever, but admitted that you can look ahead through the front window while doing this, and he has never had an accident due to failure to observe signals or highway crossings (67,
225 112–113). Another said at times you have to take your eyes away from the front window to brace yourself and reach for the reverse lever (177). Another said it was almost impossible to keep looking out when hooking up the lever (700), but admitted

that he can keep a lookout when reversing the engine when working ahead in switching service (702). Another said he was unable to keep his eyes on the track ahead while hooking up or dropping down the lever in passenger service (790), and still another said this takes your attention away from the way you are running (973). Since the choice of time to hook up or let down the lever rests with the engineer it is obvious that he need not do so at the precise time of approaching a highway crossing or a signal tower (60, 5907).

"While some of these witnesses testified regarding switching movements that it was impossible while reversing their engines for them, as engineers, to keep their eyes on the men working on the ground giving signals (135, 136, 931–2), it is an admitted fact that this operation of reversing the engine is performed while the engine is standing still, and further that it is not necessary for the engineer to keep his eyes on the members of the switching crew while reversing the engine, as he has ample opportunity to put his head out of the window immediately afterwards and observe the signal before proceeding with the next movement (226–8).

"A number of complainants' witnesses, moreover, admitted that they could observe such signals both forward and backward while handling the manually operated reverse levers under these circumstances and they illustrated the position which they take in the cab in so doing (435, 629, 715, 1153–4). No instance of any kind
226 was shown where an accident resulted or any danger was incurred in any manner because of any interference with observing of signals or keeping a lookout occasioned by operating the hand reverse lever.

"Forty engineers and various mechanical officials testified on behalf of respondents on this subject. (Geldbaugh, 1238–1244; Pugh, 1345; Fraley, 1468; Brotherton, 1515; Schraffenger, 1587; Route, 1654; Freeland, 1689; Ward, 1818; Crowley, 1847; McCaskill, 1879; Buell, 1889–1890; Rust, 1903; Richter, 1927; Thorp, 1990; Ellis, 2139; Blowers, 2297; Meyer, 2314; Jeffers, 2445; Fields, 2495; Doolittle, 2508; Buckner, 2513; Spikes, 2525; Williams, 2551; Loshbaugh, 2713; Beach, 2730; Knight, 2891; Curtis, 2906; Tesch, 3004–3005; 3006; Hoeft, 3135; O'Neil, 3193; Schaller, 3221; Vermeul, 3238; Haine, 3249; Flynn, 3441–3442; Dampman, 3497; Traylor, 3690; McPhail, 3751; Pulliam, 3772; Wood, 3792; Spaulding, 3833, 3838; Fitzgerald, 3850; Jones, 3865–3866; Landers, 3892–3893; Pectal, 3901; Adams, 3928; Bobbitt, 3951; Burnett, 4949; Von Bergen, 5317–5318; Hall, 5467; Moriarty, 5653; Gorman, 5748–49, 5449–50; Ford, 5893; Kerby, 5906; Mote, 6004, 6031; Abst. 3541). Their testimony shows without contradiction that during their entire service they have never at any time experienced any difficulty from, or interference on account of, operating manually operated reverse gears with respect to observing signals or keeping a look-out; that they have had experience also with power reverse gears; and that there is no difference as between the two types of gears in this respect (see abst.

35–41 and citations last above noted). In addition thereto, the testimony of mechanical officials of long experience both in
227 operating locomotives themselves and in observing and supervising such operation shows that there have never been any complaints of any such difficulty or interference, and that they have never observed anything of the kind or experienced it in any way (Adams, 3928; Bobbitt, 3951; Knight, 2891; Jeffers, 2445; Curtis, 2906; Tesch, 3004–05; Von Bergen, 5317–18; Hall, 5467; Moriarty, 5653; Gorman, 5748–50; Ford, 5983; Kerby, 5906; Traylor, 3690; McPhail, 3751; Pulliam, 3772; Wood, 3792).

"The whole testimony in the case definitely proves that the use of manually operated reverse gears has not, and does not, interfere with the engineer's observation of signals or keeping a look-out so as to affect safety of the operation of the locomotive in any manner."

Cost of applying power reverse gears

30. The words and figures "approximately $400.00" appearing in line 15, sheet 46, are incorrect, and should be corrected by substituting for them the figures "$411.68" (5849–52, exh. 92).

Power reverse is much more expensive to maintain than hand reverse

31. The sentence appearing at lines 16 and 17, sheet 46, with respect to power reverse gear being more expensive to maintain than hand reverse gear, does not fully and adequately state the evidence on that subject, and should be amplified by adding the following:

"Comparative records compiled and statements made by me-
228 chanical officers of various railroads show that the maintenance cost of power reverse gears is many times the expense of maintaining hand reverse gears (Cunningham, 5835; Ward, 5790; Reddix, 3646–53; McFarland, 1740–50; Holmquist, 2802; Burnett, 4998–5001, exh. 55 & 56; Hall, 5470."

Complainants' contention of increased efficiency with power reverse not sustained

32. The statement appearing in lines 17 to 22, inclusive, sheet 46, with respect to complainants' claim of increased efficiency on account of faster operation of locomotives equipped with power reverse gears, and defendants' contention to the contrary, is incomplete in that it fails to state what the evidence shows with respect to these contentions. The following summary of the facts established by the evidence in this case should be added to the above-mentioned statements of the contentions of the parties:

"The evidence fails to sustain complainants' contention of increased efficiency in locomotive operation on account of applying power reverse gears. On the contrary, much uncontradicted evidence in the record fully establishes defendants' contention that such

installation and use has resulted in a loss of efficiency in locomotive operation and performance in many instances (1243, 1248–49, 1241–2, 1283–5, exh. 109, 1339–40, 1376, 1343, 1402, 1475–76, 1591, 1654, 1674, 1813, 1815, 1885, 1907, 1936, 1929, 2029–30, 2078–79, 2100, 2135, 2227, 2245–47, 2247–48, 2300, 2308, 2371, 2373–74, 1413, 2411, 2445, 2548, 2557, 2591, 2634, 2678, 2746, 2773, 2808, 2855–56, 2857, 2883,
229 2962, 2976–77, 3013, 3068, 3105, 3148, 3149, 3173–76, 3195, 3212, 3221, 3226, 3275, 3272, 3283, 3349–50, 3352–53, 3404, 3417, 3433–34, 3422, 3441, 3446, 3457, 3475–79, 3498, 3534, 3566, 3570, 3670, 3680–81, 3698, 3839, 3853, 3856, 3876, 3902–03, 3953, 3999, 4003, 4837–38, 4861, 4973, 4975, 4972, 4974, 5324, 5327, 5333–34, 5402, 5503, 5471, 5585–86, 5628, 5654, 5646–47, 5708, 5718–20, 5721, 5757, 5748, 5795, 5904; abst. 115–126)."

"Creeping" generally experienced with power reverse; resultant decreased efficiency

33. The last sentence on sheet 46 is incomplete and fails to state the substance and effect of the uncontradicted evidence in the case with respect to creeping of power reverse gears. It should be revised and amplified so as to briefly summarize the substance and effect of the uncontradicted evidence in the case as follows:

"Creeping makes it impossible to use steam in the most economical manner, and this results in unnecessary fuel consumption and use of water. Many instances and experiences of this kind were shown by defendants' evidence covering a wide range of territory and operating conditions and on many different railroads (see citations last above, abst. 115–126; and 1239–40, 1283–87, 1256–58, 1339, 1340–41, 1360–61, 1397, 1403–04, 1399, 1471, 1473–75, 1504, 1515, 1516, 1517–18, 1518–21, 1558–59, 1562, 1588–89, 1620, 1649–51, 1652–53, 1715, 1690–96, 1697–1701, 1740–45, 1750, 1773, 1799, 1810, 1833, 1811, 1883, 1905–07, 1907, 1921, 2103–14, 2061, 2103, 2128, 2129, 2180, 2213–15, 2220–21, 2224, 2241–42, 2287, 2293, 2298–2300, 2302–03, 2356–57, 2370–71, 2376–77, 2392, 2395, 2399, 2402, 2400, 2408–11,
230 2515, 2572, 2591, 2608, 2664, 2704, 2744–47, 2772, 2802, 2808, 2855, 2879, 2933, 2975, 2982, 3006–07, 3065–66, 3100–02, 3138, 3147–48, 3171–74, 3193, 3212, 3221, 3237, 3275, 3316, 3348–49, 3403–04, 3407, 3416, 3441, 3445–46, 3456, 3470, 3473, 3497, 3517–18, 3534, 3544–45, 4566, 3646–49, 3650–53, 3652–57, 3683, 5258–66, 3753–54, 3769–71, 3797, 3837–38, 3852, 3868–69, 3876, 3902–3, 3929, 3953, 3999, 4826, 4849–51, 4841–42, 4861, 4872–73, 4882, 4889, 5079–81, 5084, 5136, 5138, 5185–86, 5194–95, 5246, 5323–26, 5358, 5373–74, 5418, 5471, 5560, 5564, 5592–93, 5626–27, 5644–46, 5702, 5757, 5795, 5802, 5837, 5893–94, 5904, 5963; abst. 70–97).

"This evidence shows that a considerable amount of creeping has been experienced on practically every railroad; that it has occurred with all of the different makes and types of power reverse gears; that it has occurred repeatedly and continued in spite of intensive efforts on the part of railroad mechanical forces to maintain power reverse

gears at a high standard; that repairs frequently eliminate the creeping temporarily; and that it often reoccurs (Pugh, 1360–1, abst. 71; Brotherton, 1515–16, 1518–21, 1558–9, abst. 72; Herrick, 2013–14, abst. 75–6; Reddix, 3649–50, 3646–57, 3683, 5258–66, abst. 88–9; Tesch, 3006–7, abst. 82). The testimony of numerous mechanical officials shows that creeping of power reverse gears is still prevalent in spite of intensive efforts to overcome same, and although improvements have been made, no power reverse gear has as yet been made which will give a continuous positive control of the locomotive valve that can be depended upon under ordinary conditions of operation (5757, 5893–4, 5471, 5592–3, 5795, 5839, 5904).

Defendants' evidence regarding creeping and resulting loss of
231 efficiency in locomotive operation is supported by complainants' evidence on these subjects, which includes not only engineer witnesses but representatives of the principal power reverse gear manufacturers (Stone, 110–11; Brown, 391; Austin, 611–12, 625–7; Williams, 652, 656; Rudolph, 722–3, 729–30; Rasmussen, 769; Adams, 797; Underwood, 832–3; Crum, 870–1; McHugh, 6071, 6076–8, 6083–4; Davis, 6102, 6110–13; Nelson, 6137–42; Miller, 6159–60; Meagher, 6164, 6167; McKeaney, 6186–7; Hartle, 6212–13; Acker, 6237; Boa, 6316–19, 6323–6; Erisman, 6331–33, 6335–37; Zouck, 6354, 6360–3, 6366–72, 6375–6; Robinson, 6378–89; Mellor, 6394; Johnson, 6431; abst. 64–70)."

Erratic performances and failures with power reverse gears

34. The proposed report is incomplete in the further respect that it fails to mention a considerable amount of uncontradicted evidence as to erratic performance and failure of power reverse gears. The following statement of the evidence in these respects should be added following the statement last above set forth:

"In addition to the cases above mentioned in which personal injuries, deaths, or serious property damages resulted from the use of power reverse gears, numerous instances were shown where these gears for one reason or another failed to function or acted in an erratic manner with resultant delays and exposure to personal injury, death, and property damages in various ways. Many instances

were shown where failure of the power reverse gear to func-
232 tion properly resulted in engines reversing themselves while running at high speed—i.e., the reverse gear would go into back motion while the engine was moving forward, thus throwing a terrific strain upon all parts of the machinery, causing the engine to "buck", jump up and down and jolt the train (1523–4, 1708, 1921–2, 2014–15, 2016, 2021, 2219, 2236, 2243, 2357–9, 2371, 2402, 2542, 2544–5, 2936, 3010–11, 3194–5, 3222, 3755–6, 2129, 2392, 2396, 4829–31; abst. 70–97, cases designated "(f)." A considerable number of witnesses in working around locomotives had observed portions of the valve gears moving when the engine was standing still and no movement of the operating lever, while air was being pumped up on the loco-

motive (1256–8, 5418, 1403–04, 1517–18, 1649–51, 2293, 2303, 2376–7, 3100–02, 3146, 3407, 3497, 3544–5, 3876, 5246, and numerous other cases, see abst. 70–97). Other witnesses testified to numerous cases where excessive creeping, pumping, jumping, or fluttering of power reverse gears caused breakage of other operating parts of locomotives (1690–6, 1697–1701, 1703, 1833, 3209–11; Knight, 2892, abst. 82—stripped engine; Murphy, 2982–3, abst. 82—broke air pipe, stopped train; Tesch, 3006–07, abst. 82—broke driving wheel centers; Hoeft, 3147–8, abst. 84—disabled injector; and numerous other cases designated "(e)"; abst. 85–97), or parts of the reverse gear became broken or detached or leaked (1811, 2022–5, 2248–9, 2542–3, 2547, 2892, 2982, 3041–2, 3066, 3171–2, 3223–4, 3261–64, 3279, 3756–7, 1773; Love, 3041–2, abst. 83—reverse cylinder torn off boiler and fell to ground at 55 miles per hour; and numerous other cases designated "(e)", abst. 85–97). Numerous instances occurred where the power reverse gear was rendered absolutely inoperative and failed to
233 control the direction of the movement of the locomotive, due to power reverse gear freezing in cold weather. This resulted in delay on account of the necessity of thawing out the power reverse gear before being able to move same. In one such instance the locomotive was stalled in such circumstances on the main track in front of an approaching fast passenger train (3563–5, 1253, 1390–92, 1522, 1620–1, 1928–9, 2132–5, 2375–6, 2537–8, 2064–6, 2684, 2714, 2892, 3138–43, 3418–19, 3893–5, 4901, and numerous other cases, abst. 85–97).

"Such erratic performance and failures interfere with efficient and economical operation, resulting as they do in rough handling of trains, train delays, engine failures, and damage to parts of the locomotive of trains. In all of these cases the possibility of attendant personal injury or death existed to a greater or less extent. That, taken with the accident evidence involving power reverse gears, shows that the possibility of personal injury is by no means eliminated by installation and use of power reverse gears on locomotives, and that numerous situations have arisen, and may reasonably be expected to arise in the future, in the operation of engines equipped with power reverse gears, involving possibilities for personal injuries, deaths, and/or serious damage to property, which do not arise on engines equipped with hand reverse gears."

The proposed order would require immediate and continuous heavy expenditures by carriers

35. Exception is taken to the statement in conclusion beginning with line 29, sheet 37, and ending with line 16, sheet 48, as to
234 the number of locomotives below certain weights on the drivers being out of service, the number set aside for repairs, and the percentages of each equipped with hand reverse levers being large, and the conclusion that the carriers will not be required to immediately make large expenditures in order to comply with the

proposed order, because the said statement and conclusion are unwarranted and unsupported by the evidence in the following respects:

"(1) While the evidence shows a large amount of power on certain railroads as stored serviceable, it does not show the percentage thereof equipped with hand reverse gears.

"(2) While the evidence shows that certain locomotives on certain railroads have been listed for retirement, the evidence is not comprehensive of the entire situation in this respect and fails to show how large a percentage of engines listed for retirement are equipped with hand reverse gears.

"(3) Programs for retirement of locomotives are tentative only, and changing conditions and modes of transportation may result in many of the lighter engines, equipped with hand reverse gears, previously considered for retirement, being retained indefinitely in service.

"(4) The evidence shows that to comply with the proposed order, 17,981 of the locomotives which were in service December 31, 1930, on class 1 railroads, would have to be changed over from hand reverse gears to power reverse gears at an average cost of $411.68, per locomotive, making the aggregate cost $7,402,418.08, and while it is true that the proposed order would not require this expense all to be made immediately, since it would all have to be made be-
235 fore January 1, 1936, and these gears must be applied upon the making of class 3 or heavier repairs, it is evident that a substantial outlay would be required immediately and continuously during the period prior to January 1, 1936 (exh. 10, 58, and 92; 5849–52)."

The above-mentioned passage should be eliminated from the proposed report.

Ultimate and decisive facts established by the evidence

36. Exception is taken to the conclusion set forth in lines 17 to 20, inclusive, sheet 48, to the effect that it is unnecessary for the Commission to give further consideration to the question of safety and the relation of the accident evidence in this case thereto, for the reason that such conclusion would lead the Commission to disregard the substance and effect of the most essential evidence in the case and, assuming, but not admitting, the Commission's jurisdiction, it is proper and altogether necessary that the Commission should consider and state the following ultimate facts and conclusions established by the uncontradicted evidence in this behalf. Defendants propose the following statement in lieu of said lines 17 to 20:

"The evidence in this case establishes the following facts:

"(1) That installation and use of power reverse gear on locomotives have not eliminated accidents in the operation thereof,
236 caused by or in connection with the use of reversing gear or by the failure of the reversing gear to function properly.

"(2) That such accidents with power reverse gear equipped engines have included the same types as have heretofore occurred on locomotives equipped with manually operated reverse gears, viz strains, bruises, cuts, broken bones, etc., received in connection with the action of, or the handling of, the reverse gear lever or wheel, in the engine cab, and injuries to enginemen and others while oiling or otherwise attending to locomotives outside of the cab, the evidence in this case disclosing more numerous accidents of the former type with hand reverse gear, and of the latter type more numerous accidents and much more serious injuries, including several deaths, resulting from operation of power reverse gears.

"(3) That several types of accidents have occurred in the operation of locomotives equipped with power reverse gear due to the absence of, or insufficient amount of, air pressure causing the reverse gear to be inoperative (which have not occurred and cannot occur in operating engines equipped with manually operated reverse gears) a number of which accidents have resulted in serious personal injuries and/or deaths of employees.

"(4) That in cases of loss of air supply on power reverse gear equipped engines running light—*i.e.*, without cars attached—on descending grades there have been several collisions and derailments with resultant loss of life, serious personal injury, and serious property damage, as well as great danger to other trains and passengers thereon, which could have been avoided had those engines been equipped with manually operated reverse gears by using same
237 as an emergency measure for braking purposes, the power reverse gear being unavailable for that purpose when air supply sufficient to reverse the engine is not available.

"(5) That in numerous instances around terminals, when engines move without sufficient air supply to operate the brakes they were readily controlled by emergency use of the manually operating reverse lever for braking purposes and serious accidents prevented, whereas in numerous instances under similar circumstances engines equipped with power reverse gears have been uncontrollable due to the reverse gear being inoperative for the same reason and at the same time the brakes were inoperative, and as a result thereof numerous accidents have occurred in the way of collisions, engines running into turntable pits, through roundhouse walls, into shops, etc., in which serious personal injuries and death of employees have resulted, and serious property damages have occurred.

"(6) That numerous accidents have occurred because of the creeping of power reverse gears and in connection with efforts of enginemen and other employees to repair or adjust same to overcome this creeping, which have resulted in serious and permanent personal injuries, followed in one case by death of the engineer. Such experiences have not occurred with manually operated reverse gears because creeping does not occur with such type of gear.

"(7) That power reverse gears, being a more complicated device than manually operated reverse gears and composed of several times

greater number of parts, many of which must be maintained so
238 as to prevent leakage of air held under high pressure, require several times as much attention as manually operated reverse gears in their maintenance, and any slight deviation from perfect condition will result in excessive creeping or other erratic performance, which is not true with manually operated reverse gears.

"(8) That the accident evidence in this case shows that the great majority of injuries occuring on locomotives equipped with hand reverse gears are composed of strains and minor cuts and bruises such as customarily occur in any line of work involving any degree of physical activity and are necessarily involved therein because of the element of human fallibility. With two or three exceptions the injuries shown to have resulted in connection with the use of manually operated reverse gears were temporary in nature and the large majority of them were extremely trivial, resulting in only a few days' loss of time. On the other hand, nine deaths are shown to have resulted from the operation of locomotives equipped with power reverse gears, and a considerable number of permanent and serious personal injuries to have resulted from such operation, which would not have occurred had the locomotives at the time been equipped with manually operated reverse gears.

"(9) That the number of accidental injuries reported to the Commission's Bureau of Statistics and filed by the Bureau under the classification 'Reverse lever, operating', as well as all accidental injuries reported, has decreased rapidly within the six years ending with the year 1930, due to educational work and persistent effort of the 'Safety First' committees on the various raliroads. The above classification includes accidents on locomotives equipped
239 with manually operated reverse gears and those equipped with power reverse gears, but because of the nature of accidents with power reverse equipment a great many such accidents are not filed under the above classification, or any other single classification, but are scattered throughout all of the numerous classifications of the Bureau statistics, and therefore no statistics are available to show how numerous such accidents are and whether or not they have decreased in recent years as fast as accidents occurring on engines equipped with manually operated reverse gears. Likewise no statistics are available to show the comparative frequency of power reverse and hand reverse gear accidents.

"(10) The evidence in this case fails to establish that the locomotives now equipped with manually operated reverse gears are not by reason of such equipment in proper condition or safe to operate in the service to which same are put, that the same may not be employed in the active service of the various carriers without unnecessary peril to life or limb. (These being essential propositions which complainants have undertaken to prove in this case.)

"(11) The evidence further fails to establish that it is necessary to equip all, or any, of the said locomotives with power reverse gears in order that they may be placed in proper condition or safe to oper-

ate in the service to which same are put, that the same may be employed in the active service of the various individual carriers without unnecessary peril to life or limb.

"(12) The present rule (no. 157) respecting reversing gears was considered adequate when approved by this Commission in 1915, and the evidence in this case fails to show that conditions now with
240 respect to manually operated reversing gears are any worse from the standpoint of safe operation of locomotives than at that time. On the contrary, the evidence shows very great improvement in conditions with respect to the design, maintenance, care, and operation of manually operated reverse gears as they now exist compared to 1915. If on any particular locomotive unsafe conditions respecting manually operated reverse gears or clearances around same exist, the district inspector having jurisdiction thereof may proceed under the above rule and under the Boiler Inspection Act to take the locomotive out of service and hold it until such condition is rectified. No modification of the rule respecting reversing gears is shown to be needed at this time, and none should be approved by this Commission."

Restatement of the issues of fact

37. Assuming, but not admitting the Commission's jurisdiction in this matter, the statement of the issue of fact presented for the Commission's decision, as set forth in lines 22 to 27, inclusive, sheet 48, is incorrect under the boiler inspection law, the complaint, and the complainants' proof herein, and should be revised to read as follows:

"The questions before the Commission in this case are:

"(1) Whether or not the complainants have proven the allegations of their complaint that all locomotives equipped with manually operated reverse gears are not 'in proper condition and safe to operate in the service to which same are put * * * that
241 the same may be employed in the active service of such carriers without unnecessary peril to life of limb' because 'said manually operated reverse lever is inherently improper, unsuitable, and unsafe in principle and design' (complainants' sections III and IV); and

"(2) Whether or not the complainants have sustained the burden of proving further, with respect to said locomotives, that the only way of putting them 'in proper condition and safe to operate in the service to which the same are put * * * that the same may be employed in the active service of such carriers without unnecessary peril to life or limb" will be to equip them with power reverse gears.*"

* NOTE.—The prayer of the complainants in part reads: "that the Commission make and prescribe appropriate rules and regulations for the equipment of all locomotive engines propelled by steam power with power reverse gear, or other devices adequate to protect the employees upon said locomotives from unnecessary peril to life or limb, as provided in section 2 of said Boiler Inspection Act, as amended", but complainants during the conduct of the case have limited their demands to power reverse gear, eliminating "other devices."

The fact that the carriers have extensively equipped locomotives with power reverse gears does not support complainants' contentions

38. Exception is taken to the conclusion set forth in lines 28 to 32, inclusive, sheet 48, because said conclusion ignores and is contrary to the undisputed evidence in the case referred to in detail in these exceptions showing that power reverse gears have become a necessary feature of the design of modern locomotives because of the in-
242 creased width of fire boxes, with the resultant lack of clearance and room in the cab, making it mechanically awkward to design and install manually operated reverse gears on such locomotives (see exception no. 21 and references, pages 65–6 hereof); showing that where locomotives have been changed over from manually operated reverse gears to power reverse gears, the latter have been installed as a labor-saving device so as to make work easier for the men (see exception no. 12 and references, pages 32–3 hereof); and that although there may have been some thought of securing greater efficiency with power reverse gears, a considerable loss of efficiency and economy in locomotive operation has resulted from their use up to the present time (see exceptions nos. 32 and 33 and references, pages 83–6 hereof) and establishing that safety of locomotive operation has never been considered as being in any manner affected, either by the managements, the men, or the manufacturers of power reverse gears in connection with their installation (see exceptions nos. 12 and 21 and references, pages 32–3, 65–7 hereof); and that neither gear can seriously be considered to the exclusion of the other from a safety standpoint, neither being a safety device, and either one being an essential part of the locomotive machinery, equipped with which the locomotive meets the standard laid down in the boiler inspection law (see exceptions nos. 2 and 12 and references, pages 4–5, 32–3 hereof).

Said lines 28 to 32, incl., should be eliminated.

243 Creeping is a serious difficulty with power reverse gears which it has been impossible to materially overcome.

39. The conclusions set forth in the two sentences included in lines 1 to 4 inclusive, sheet 49, that creeping is largely a question of maintenance and if power reverse gears are properly maintained creeping to any material extent will be largely eliminated, are incorrect and contrary to the undisputed evidence in the case, and should be eliminated from the report.

While unquestionably the evidence shows that a large amount of the creeping which has been experienced has resulted from failure to maintain these complicated mechanisms in air tight condition and otherwise to that fine degree of adjustment required for their proper functioning, the evidence also establishes that the managements of the various railroads and their mechanical forces have put forth every reasonable effort and spared no expense in an endeavor to

overcome and control this evil of creeping; that cooperation, advice, and action have been requested and received from the manufacturers of power reverse gears through their service men and officials; and that as a result of all this effort and expense, together with the experimentation and bringing out of new designs and devices in the gears by the manufacturers, the situation has been improved to some extent, yet the record amply establishes the fact that a consid-
244 erable amount of creeping is still being experienced and that as a matter of fact comparatively little progress has been made in overcoming it up to the present time (see exception no. 33 and references, page 84–6 hereof; see also R. 2213–4, abst. 77; Holmquist, 2802, 2808; Williams, 2591; Reddix, 3646–57, 3683, 5258–66; Tesch, 3006–11; McFarland, 1799; Hall, 5469–71, 5475; Crabbs, 5593; Gorman, 5756; Ward, 5801–2).

With hand reverse gear there is ability to detect obstruction in valve gear so as to avert serious injury where not possible with power reverse.

40. Exception is taken to the sentence included in lines 4 to 7 inclusive, sheet 49, expressing the conclusion that there is no greater ability on the part of an engineman to detect an obstruction in the valve gear with hand reverse gear than with power reverse gear, because such conclusion is contrary to the undisputed evidence in the case, showing an instance where the fireman in moving a hand reverse gear to forward motion felt the obstruction of the engineer's head between the tumbling shaft arm and the end of the driving spring, arrested and immediately reversed the movement of the hand lever so that the engineer received only a cut on the temple and face but was not seriously injured and was able to go on with his trip (2835–46, abst. 61–21), as against which there is evidence of numerous accidents where power reverse gears were moved under similar
245 circumstances and the operator of the lever felt no obstruction, with the result that the movement of the valve gear was not arrested and the employee—who was not in the clear of the valve gear parts—was crushed and killed (Boggs case, 1857–66, 1868–9, 5320–22, abst. 137–8, 161; Garrett case, 2820–6, abst. 145–6; Bunnell case, 4885, 4861–78, 4951–7, abst. 152–3; 154; Nomato case, 5146–53, 5156, abst. 156–7; Abbott case, 5209–15, abst. 158). In the opinions of witnesses to these accidents and experienced mechanical men, serious injuries would not have resulted in any of these cases had the locomotives been equipped with manually operated reverse gears. These opinions are supported by sound reason based upon the differing characteristics of the two types of gear, and are further supported by the fact that complainants sought on rebuttal to produce evidence of accidents occurring under similar circumstances with manually operated reverse gears, but were unable to produce any case where a serious injury had occurred in this manner in connection with the operation of such gears, the only rebuttal proof being

that of one case where a man's little finger was mashed by the yoke of the reversing gear coming up against the supporting frame at the extreme end of the movement of the level (6435–7, abst. 59–60). So far as this record shows, and as the parties are advised, there has never been a case of serious injury or death occurring in this manner with a hand reverse gear equipped engine.

246 The following statement should be substituted for said sentence in lines 4 to 7:

"As to ability to detect an obstruction in the valve gear, such as a man's head or arm, by resistance offered to movement of the hand reverse gear, in time to avoid injury, the evidence clearly establishes that there is an advantage with hand reverse gears in being able to avoid accidental injuries in this respect. The evidence discloses no case of this character where serious injury resulted with hand reverse gear, whereas several serious injuries and deaths are shown with power reverse gear. Furthermore, uncontradicted testimony of expert witnesses support the above conclusion."

Auxiliary steam supply will not prevent power reverse accidents

41. The sentence included in lines 7 to 10, inclusive, sheet 49, stating the conclusion that power reverse gears becoming inoperative while on the road because of lack of air pressure could be taken care of by properly applied and maintained steam connections, is excepted to because it is contrary to the evidence in this case which shows a number of cases of serious accidents resulting in collisions, derailments, property damages, serious personal injuries, and deaths caused by power reverse gears becoming inoperative due to this cause, the time limit or other circumstances being such that it was impossible to make use of the auxiliary steam connection so as to prevent the accident, whereas if equipped with a manually operated reverse

247 gear the locomotive could have been controlled and the accident averted (Mote case, 5990–6, abst. 166–7; Cooksey case, 3317–32, exh. 40 and 90, abst. 148–9; Bailey case, 4893–4900, abst. 153–4); and further evidence in this case indicating the unsuitability of and difficulties encountered with the auxiliary steam supply pipe in the matter of moisture therefrom getting into the reverse gear cylinder and causing the reverse lever to freeze and become inoperative; with regard to the steam destroying the packing and making the power reverse gear inoperative, or resulting in excessive creeping; with respect to increased maintenance difficulties and expense in connection with such auxiliary steam supply, resulting in such installation being eliminated on at least one railroad (McFarland, 1740–41, 1742–45, 1750, 1773, 1799, abst. 74; Kerby, 5904, abst. 125–26; Aita, 2748–54, abst. 145; Burnett, 4972–75, abst. 122–23; and other references, exceptions nos. 23–25, p. 69–73, hereof).

The following statement should be inserted in lieu of said sentence in lines 7 to 10:

"The evidence establishes that auxiliary steam connections are sometimes ineffective in emergencies to restore operation of power reverse gears while on the road due to loss of air pressure. Several serious accidents involving serious personal injuries and death have occurred in this manner which very likely would have been avoided with hand reverse equipment."

248 Engines crashing into round-house walls or turntable pits—statement corrected

42. Exception is taken to the statement regarding engines moving unexpectedly and crashing through roundhouse walls or into turntable pits not being confined to locomotives equipped with power reverse gear, as set forth in lines 10 to 15, inclusive, sheet 49, in that said statement ignores an essential element of the uncontradicted evidence in the case, and if left to stand as stated might therefore lead to an incorrect conclusion, and for the further reason that it goes outside of the record and attempts to state certain facts as matters of common knowledge.

The defendants have shown numerous cases where locomotives equipped with power reverse gears moved unexpectedly around roundhouses or terminals, and because of insufficient air pressure the employees at hand were unable to control such locomotive either with the brakes or by use of the reversing gear for braking purposes. In a number of these cases serious injuries and property damage occurred, and on one of them one employee was killed and two others seriously injured. It is shown that in practically every one of these cases had the locomotive at the time been equipped with manually operated reverse gears, they could have been controlled so as to have prevented these accidents and the resultant injuries, death, and damages, notwithstanding that the air pressure was not sufficient
249 to hold the brakes. This could have been accomplished by using the manually operated reverse gear for braking purposes, by throwing the gear into the position opposite that of the movement of the locomotive and admitting steam to the cylinders, working the pressure against the piston heads (see exception no. 18 and citations, page 54–6 hereof).

Defendants have also shown in the evidence, numerous cases where serious accidents have been averted under similar circumstances by using hand reverse gears for braking purposes (see exception no. 26 and citations, pages 73–4 hereof).

These cases show the superiority of the hand reverse gear over power reverse gear for emergency use for braking purposes, and that it can be used for such purposes in all instances where power reverse gear can be used, and also in those cases where power reverse gear cannot be so used because of the absence of air pressure. That a locomotive may move unexpectedly from any one of a number of causes and regardless of whether it is equipped with a power reverse

gear or hand reverse gear, may readily be admitted. Such statement alone, however, is quite beside the point, which is that when such occurrences take place and there is insufficient air pressure on the locomotive to operate the brakes, the locomotive may, if equipped with a hand reverse gear, then be controlled by use of the reversing gear for braking purposes, whereas if equipped with power reverse gear it cannot be controlled. The statement above ex-
250 cepted to should be revised to read substantially as follows:

"As regards locomotives moving unexpectedly and crashing through roundhouse walls, into turn-table pits, or colliding with other engines or trains when there is insufficient air pressure to control same with the brakes, the uncontradicted evidence in this case establishes the fact that it is possible under such conditions to control such locomotives by using the reversing gear for braking purposes if equipped with manually operated reverse gear, while the absence of air pressure makes it impossible to do so if equipped with power reverse gears. The evidence further shows a considerable number of cases where accidents were averted in this fashion by use of hand reverse gears, and where it was impossible to avert such accidents on engines equipped with power reverse gears, as the result of which serious property damage, personal injury, and one death occurred."

Accidents with obsolete power reverse equipment—statement corrected

43. Exception is taken to the statement included in lines 16 to 21, inclusive, sheet 49, to the effect that several accidents and much trouble shown in the record on engines equipped with power reverse gears occurred on locomotives equipped with what are now obsolete installations, because such statement is over-drawn and may lead to an incorrect understanding of the evidence. The statement should be revised to read as follows:

"Three minor accidents shown in the record as occurring in
251 operation of power reverse gears occurred on locomotives equipped with the so-called "Mellin" gear, which is now considered by some roads to be obsolete although still in use on other roads (Fraley, 1387–9, abst. 135; Truman, 2968–71, 2975, abst. 146–7; Maloney, 5616–17, abst. 163).

"A very few of the cases of erratic performance resulting in train delays and engine failures also occurred with this type of gear. All of the remaining accidents, including the nine deaths, attributed to operation of power reverse gears and nearly all of the erratic performance cases shown of record, have occurred with the modern types of gear which are still in general use, many of them occurring with the very latest gears which, however, are shown by the record not to be very greatly different from the same types or makes of gear which have been in use since 1915, and the great majority

of these accidents have occurred in very recent years. (See all accidents, abst. 135–167, except the three above noted; see all instances of erratic performance, abst. 70 to 97, indicating Mellin gear only mentioned by two witnesses, viz: Fraley, abst. 71, and McFarland, abst. 74.)"

Relative importance of serious and minor injuries

44. Exception is taken to that part of the proposed report beginning with line 22, sheet 49, and ending with line 8, sheet 50, wherein reference is made to the Commission's decision in Public Utilities Commission of Ohio v. Pennsylvania R. Co., 151 I.C.C. 448, at page 464, with reference to the relative importance of serious or fatal injuries and minor injuries, because application
252 of the principle announced by the Commission in that decision to the evidence in this case must undeniably result in a decision by the Commission at this time that the evidence does not justify it in approving an order which would require the installation of power reverse gears upon all, or any part, of the locomotives now being operated by defendants which are equipped with manually operated reverse gears. It may or may not be true that there have been a greater number of injuries occurring in connection with reversing gears on locomotives equipped with hand reverse gears than on those equipped with power reverse gears, it being impossible to state from the record in this case, or from statistics available in the Bureau of Statistics, whether this is true or not. But it is undeniably true, as shown by the evidence in this case, that there have been a considerable number of more serious accidents in connection with operation of power reverse gears on locomotives so equipped, and that there have been nine deaths attributable thereto, while there have been only one or two permanent injuries and no deaths in connection with operation of hand reverse gears. The only death in connection with the operation of locomotives so equipped occurred because of the inability of a hostler to use the hand reverse gear as an emergency measure for braking purposes, and his being thus unable to avert the accident as he would have been unable to avert it had the engine been equipped with a power reverse gear. These facts definitely demonstrate that
253 the Commission under the principle announced in the above decision could in no sense be justified in ordering power reverse gears to be installed upon the defendants' locomotives as a safety measure.

The question asked of two or three witnesses for defendants as to whether or not the Commission should require power reverse gears to be removed and hand reverse gears substituted therefor, and the negative answers received by the examiner to such questions along these lines, while going into issues not before the Commission in this proceeding, nevertheless fail to furnish any basis for an order re-

quiring installation of power reverse gear in this case, for the witnesses who were asked these question made it plain that they considered neither one of these devices as a safety device and that a locomotive equipped with either one of these devices properly maintained, meets the standards of the boiler inspection law. (See exceptions nos. 12 and 21 and references cited at pages 32–3, 65–8, hereof.)

The only conclusion which the Commission can reasonably or logically reach under the evidence in this case would necessarily be that under the rule announced in the above decision the Commission would not be justified in ordering power reverse gears to be installed upon any locomotives now equipped with manually operated reverse gears, and this conclusion should be stated in the proposed report.

254 No justification for proposal based on weights on drivers

45. With respect to the paragraph occurring at lines 9 to 15, inclusive, sheet 50, defendants respectfully point out that the evidence in this case shows without contradiction that the weight on drivers of locomotives has no relation whatsoever to the issues involved in this case, and that there is no evidence in the case on either side which would justify the Commission in specifying power reverse gears upon locomotives above certain weights on drivers. It is true, as stated in the passage above referred to, that the contention of the complainants ignores differences in size of locomotives and parts thereof, differences in speed, cab clearances, and other conditions encountered in actual operation. It is likewise true that the proposed report very largely ignores these circumstances, and the effect of same would be by blanket order to require these installations upon all locomotives above certain weights on the drivers regardless of all else.

Proposal based on weights on drivers is contrary to evidence and would be unreasonable, arbitrary, and unlawful

46. Exception is taken to the paragraph beginning with line 16 and ending with line 28, sheet 50, which would require instal-
255 lation of power reverse gears on all locomotives having a weight of 150,000 pounds or more on drivers in road service, upon all those having a weight of 130,000 pounds or more on drivers in yard service, because the same is directly opposed to the uncontradicted evidence in this case, is unsupported by the evidence in any respect, and would be unlawful, unreasonable, and an arbitrary requirement if placed in force as recommended in the proposed report. As shown above the undisputed evidence in the case is all to the effect that the weight on the drivers has no relation whatsover to the question as to whether or not a locomotive is in proper condition and safe to operate as required by the Boiler Inspection Act, if equipped

with a manually operated reverse gear. (See exceptions nos. 1 and 21 and references cited, pp. 3–6 and 66–7, hereof.) Moreover, as has been shown above in these exceptions, complainants have very definitely failed to prove that the locomotives now owned and in use by defendants equipped with manually operated reverse gears do not comply with the standard set by the boiler inspection law, or that there is any necessity or even desirability of equipping such locomotives with power reverse gears in order to make them meet the standard prescribed by that law. (See exceptions nos. 16 to 20 and 29 and references cited on pp. 42–68 and 79–82, hereof.)

256 Number and cost of installation—Statement corrected

47. Exception is taken to the statement made in lines 1 to 3, inclusive, sheet 51, to the effect that adoption of the recommendations put forth in the proposed report would require installation of power reverse gears on approximately 14,000 locomotives now in use, because said statement is incorrect and is contrary to the evidence which indicates that the recommendation proposed would require installation of power reverse gears on approximately 17,981 locomotives which were in active service equipped with manually operated reverse gears on December 31, 1930, and that the cost of so equipping said locomotives would be approximately $7,402,418.00 (5848–52, exhibits 58 and 92).

Exception to final conclusion

48. Exception is taken to the final conclusion stated in lines 4 and 5, sheet 51, to the effect that the Commission should enter an order amending the present rules under the Boiler Inspection Act in accordance with the recommendations set forth in the proposed report, for the following reasons:

"(1) Such conclusion and the recommendations of the proposed report are not supported by any substantial evidence in the record in this case.

"(2) Such conclusion and recommendations are contrary to the uncontradicted evidence in the record in this case.

257 "(3) Such conclusion and recommendations are contrary to the weight of the evidence in the record in this case.

"(4) Such conclusion and recommendations are contrary to the law and without any warrant in law.

"(5) Such conclusion and recommendations, if adopted and ordered by the Commission, would constitute an arbitrary, unreasonable, and unlawful act on the part of the Commission.

"(6) The adoption and enforcement of such conclusion and recommendations would deprive defendants of their property without due process of law, and constitute taking of same without just compensation in violation of the fifth amendment of the Constitution of the United States."

II

Exception to proposed conclusion of law that financial condition of carriers cannot be considered

Exception is taken to that part of the proposed report in lines 1 to 28, inclusive, sheet 47 thereof, in which the conclusion is stated that the question of the financial ability of the defendants to apply the requested equipment cannot, as a matter of law, properly have any bearing upon the decision in this case, because, assuming but not admitting the Commission's jurisdiction in this matter, such conclusion is illogical, unreasonable, arbitrary, and unlawful.

258

III

Exceptions to the proposed conclusions of law as to jurisdiction of the Commission

Exception is taken to the statements and conclusions set forth on sheets 4 to 7, inclusive, and the first three lines on sheet 8 of the proposed report, with respect to the questions of the Commission's jurisdiction in this matter, because the same insofar as they hold that the Commission has any jurisdiction to entertain a complaint in this case or proceed in any manner thereunder, are without warrant or authority in law and are contrary to the law in the following particulars:

" (1) In the several respects set forth in the amendment and supplemental answer filed by these defendants, May 11, 1931, paragraphs II, III, and IV thereof.

" (2) There is no authority conferred upon the Commission by the boiler inspection law, or any other law, to entertain the complaint in this case, or to proceed thereunder in any manner.

" (3) The only authority granted to the Commission under the boiler inspection law as amended, is to approve, modify, or disapprove such rules as may be submitted to it under the provisions of the act.

" (4) The said boiler inspection law as amended, grants to the Commission no authority to make or initiate the making of new rules.

" (5) No power is granted to the Commission under the
259 Boiler Inspection Act as amended, to modify existing rules or initiate modifications of same.

" (6) There is no authority granted to the Commission under the said Boiler Inspection Act as amended, nor under any other law, to conduct a hearing, as was done in this case, for the purpose of investigating whether or not additional rules, or modifications of old rules under the act, should be considered or formulated nor is any authority granted to proceed with the consideration or formulation thereof at such hearing, or at any other time."

260 Argument

I

As to the facts and proposed conclusions based thereon

It will be seen from the foregoing exceptions, and the statements of various phases of the evidence therein set forth, that should the Commission find it has jurisdiction in this matter, it will find no reasonable basis whatsoever for initiating or promulgating an order requiring defendants to install power reverse gears on their locomotives which are now equipped with the manual type of gear. In considering the evidence set forth and referred to in these exceptions, we desire to again impress upon the Commission the situation here found wherein this evidence stands of record in this case absolutely unchallenged and uncontradicted in any substantial or material respect.

In this behalf we respectfully refer to the brief filed herein on behalf of these defendants, pages 63 to 77, inclusive, setting forth very fully the only attempt on the part of complainants to contradict defendants' evidence, and as shown therein that attempt resulted in very largely supporting defendants' evidence instead of contradicting it. We also respectfully refer to the remainder of that brief and to the abstract filed under separate cover by these defendants, in both of which the evidence in the case on both sides, is quite fully referred to and considered.

261 Because it is our firm belief that the undisputed evidence in this case can lead the Commission to but one conclusion, and that the evidence which we have endeavored to set forth in these exceptions speaks most forcibly for itself, we feel warranted in adding but little to what has already been said in our previous brief filed herein. It is our desire, however, to invite the Commission's final consideration on the issues of fact to the following points:

"(1) The evidence discloses no unnecessary peril to life or limb in connection with the operation of those locomotives of defendants still equipped with manually operated reverse gears.

"(2) Such injuries as have occurred with such engines were minor in character, and of the class which necessarily and inevitably result from the use of simple tools in the hands of any workman.

"(3) The hazards of the engineers' employment are shown to be less than those of any other class of train service employees, and are further shown to have become substantially less each year within recent years.

"(4) Complainants' evidence in chief, consisted of selected accident witnesses, indicates one such injury with manual reverse gear each 25 years (br. 19); defendants' evidence indicates 125 witnesses with aggregate engine service of 3852 years (abst. IV–VIII) had 6 such accidents resulting in 4 minor injuries—an average of one injury every 960 years.

"(5) Since 1915, annual reports of the chief inspector of accidents investigated by the Bureau of Locomotive Inspection, show
262 that such simple devices as the grate shaker and the squirt hose, on locomotives, have been involved in more injury cases than have reversing gears.

"(6) The evidence shows no need for change in the existing rule (no. 157) regarding reversing gear; conditions as to safety seem to be very good indeed. If more rapid and further improvement is desired, simple and inexpensive devices, such as foot braces, stop blocks, guards, and increased clearances on various individual locomotives, and more careful attention to rule no. 157, constitute the field of endeavor in that regard.

"(7) A rule or order requiring these defendants to equip their locomotives with power reverse gears cannot be justified from any standpoint under the locomotive inspection law."

We respectfully ask the Commission to make a finding substantially as stated in the preceding paragraph (7).

## II

### As to financial condition and ability of the carriers

The evidence in this case of the financial condition of the railroads and the knowledge which this Commission has of that financial condition establishes conclusively that the railroads should not be required at this time or in the immediate future to assume any expenditures for improvements even though the same be to promote safety, unless the conditions to be remedied constitute a serious menace to the employes. The examiner has found that the financial ability of the carrier "as a matter of law" cannot properly have any bearing upon the decision of the Commission. We do not
263 contend that the financial condition of the railroads of the United States should be conclusive, but we do think that the financial condition of the railroads is a factor which should be considered by the Commission. If the dangers of the employment to be remedied were extremely hazardous, if frequent and serious injuries were caused to employes, then the factor of cost should be relatively not so important. If the accidents arising from the condition so to be remedied are relatively few and not of a serious nature, then the factor of cost should be given more consideration by the Commission. In other words, the importance of the factor of cost in the conclusion reached should bear a reasonable relation to the perils of the employment so to be remedied.

No machine can be made perfect. The evidence in this case shows that serious injuries and deaths can and do result from the use of the power reverse gear. A large number of minor injuries, with a very few serious ones, have resulted from the use of the manual reverse gear. The number of such injuries spread over many thousands of employes is relatively unimportant and insignificant. Undoubtedly

an examination of the records of the Interstate Commerce Commission would disclose that a far greater number of more serious accidents had resulted to engineers slipping from the steps of locomotives, alighting from locomotives, and in making necessary inspection of locomotives. In fact, no machine can be made ab-
264 solutely safe. The evidence in this case shows that the manually operated reverse gear is, as tools and machinery go, an extremely safe device.

The law under which the Commission proposes to act does not attempt to require railroads to do other than furnish appliances which do not constitute an unnecessary peril to life and limb. The statute applicable does not make the railroad liable for personal injuries unless the condition of the locomotive creates a condition where there is "an unnecessary peril to life and limb." 45 United States Code Annotated, sec. 23.

What is meant by the language "unnecessary peril to life and limb"? The language used assumes and recognizes that there is and may be some necessary peril to life and limb and imposes an obligation upon the railroad only where the machine and its appliances are maintained in improper condition and so as to be unsafe to operate. The language used permits an exercise of judgment in management, and this is expressly recognized and stated by the court in B. & O. R. Co. v. Groeger, 226 U.S. 521, cited by the examiner on sheet 47 of the proposed report. In addition to the sentence isolated and quoted by the examiner on page 527 of the opinion in that case, we invite the Commission's attention to the following quotation from pages 530 and 531 of the opinion, as follows:

"The act required a condition which would permit use of the locomotive without unnecessary danger. It left to the carrier
265 the choice of means to be employed to effect that result. * * * There is a multitude of mechanical questions involved in determining the proper construction, maintenance and use of the boilers, other parts of locomotives, their tenders and appurtenances, all of which are covered by the Boiler Inspection Act, as amended. Inventions are occurring frequently, and there are many devices to accomplish the same purpose. Comparative merits as to safety or utility are most difficult to determine. It is not for the courts to lay down rules which will operate to restrict the carriers in their choice of mechanical means by which their locomotives, boilers, engine tenders and appurtenances are to be kept in proper condition. Nor are such matters to be left to the varying and uncertain opinions and verdicts of juries. The interests of the carriers will best be served by having and keeping their locomotive boilers safe; and it may well be left to their officers and engineers to decide the engineering questions involved in determining whether to use fusible plugs or other means to that end."

It was very evidently not the intention of Congress that the locomotive and its appliances should be perfect. Whether or not an

appliance is necessary must depend in some measure upon its cost. If the appliance in question was so costly as to bankrupt the railroads required to use the same, and make it necessary on account of the cost to discontinue the use of locomotives, certainly it could not be argued that the requirement of such an appliance was reasonable.

266 The Commission in exercising its judgment must, we submit, deal with the question of hazard and likewise with the question of cost. Your attention is called to the language of Commissioner McManamy in Public Utilities Commission of Ohio v. Penn. R.R. (the fire door case), 151 I.C.C. 448, 467, in which he refers arguendo to the testimony in that case about the financial difficulties of the carriers. This language is inconclusive but it indicates at least that no exception was taken to this sort of evidence in the fire door case.

Also, in that case the Commission considered evidence of the savings resulting from the installation of automatic fire doors (page 467). If financial benefits can be considered, the theory of an absolute standard of safety recommended by the examiner breaks down, for there is obviously no difference in logic bearing upon the issues of this case between financial advantages to the carrier and financial detriments.

Believing, as stated by the Supreme Court in the Groeger case, supra, that the discretion in the matter of keeping their locomotives "in proper condition and safe to operate" can safely be, and has been, left to the carriers, we desire to point out that even if the law placed this discretion and obligation with the Commission, important elements for the Commission's consideration would be the cost to the carriers, the relation of such cost to the conditions sought to be remedied, and the carriers' ability to meet that cost. The Supreme Judiciary Court of Massachusetts has held such matters to be

267 proper for consideration by the Commission of that State in a matter involving the exercise of the State's police power to require the separation of grades at railroad crossings. See Mayor, etc., of City of Lowell v. B. & M. R.R., 130 N.E. 638, 640. The court very logically points out why this is so, saying:

"There may be a practical limit to the fulfillment of the demands of security and convenience of the public. * * * Ability to respond to financial requirements made necessary by the abolition of a crossing is a proper subject for consideration when the public security and convenience are at issue. Such consideration must be applied in the determination of many problems, home and business; they may be considered in the decision of questions affecting public convenience."

We respectfully submit that the questions of cost and financial ability of the carriers should, and, in all fairness, must be considered by the Commission.

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III

Questions of jurisdiction and procedure

The amended and supplemental answer of these defendants filed May 11, 1931, contains the following allegations:

"II

"That this Commission following the enactment of said Boiler Inspection Act and the first amendment thereof, had before it certain rules and instructions for the inspection and testing of steam locomotives and tenders and parts and appurtenances thereof, said rules and instructions having been prepared by the chief inspector pursuant to section 5 of said act; and after due consideration the Commission approved same. Thereafter from time to time changes of said rules and instructions made at the request of the carriers have been approved by the Commission.

"That said rules and instructions as thus changed from time to time contain no provisions with respect to power reverse gears, and this Commission is without authority or jurisdiction to make any rules or instructions with respect to power reverse gears under the said Boiler Inspection Act as amended, the Commission's authority under said act at the present time being limited to approval or disapproval of changes in the rules and instructions which may be submitted to it for approval pursuant to section 5 of said act.

269

"III

"That the said Boiler Inspection Act, as amended, provides that in case any district inspector shall in the performance of his duty find any locomotive or tender, or part thereof, not conforming to the requirements of the law, or the rules and regulations approved thereunder by the Commission, the said inspector shall have the right to give notice thereof to the carrier and require the same to be withdrawn from service, the carrier then having the right to appeal from such notice and decision to the chief inspector and then to the Commission itself, pending which time the equipment must remain out of service; that the carriers are also subject to penalties of $100 for every violation of such act as provided in section 9 thereof; that these remedies and means are the only means provided for the enforcement of the act and the rules and instructions thereunder, and that no right is given in said act to require the carriers as a whole to be brought in to answer charges as prayed for in the complaint herein, nor for the Commission to enter an order requiring carriers to cease and desist from violating the act as prayed for in said complaint."

At the commencement of the hearings an appropriate motion was made on behalf of these defendants, and similar motions were made

on behalf of other defendants, raising these same points as to jurisdiction and procedure, at which time there was some discussion of these points with the examiner. These motions were that the
270 complaint be dismissed, which was also the prayer of the answer above referred to. The motions were denied and exceptions taken (16–42, 1221–1230).

The locomotive inspection law, or as it more often referred to, the Boiler Inspection Act, consists of nine sections, and is of itself an independent and complete piece of legislation. The plain and unambiguous language found in section 5 of this act, fully supports the objections made by these defendants in this matter, to the effect that Congress has given no authority to the Commission to initiate, or make rules under the act. In that section the making of an original code or set of rules and instructions for each individual carrier was provided for, the proviso being that each carrier should itself prepare and file these rules and instructions within three months after the approval of the act. In order to take care of the contingency of any one or more carriers failing to do so, the act further provided that at the expiration of three months the chief inspector should prepare and file such rules and instructions to be observed by such carriers. In either case, i.e., whether prepared by the individual carriers or by the chief inspector—such rules and instructions were required to be submitted to the Commission for approval. So much for the prescribed method of making the first code of rules.

To provide for changes in these rules, the following proviso was added to section 5:

"Provided also that such common carriers may from time
271 to time change the rules and regulations herein provided for, but such change shall not take effect and the new rules and regulations be in force until the same shall have been filed with and approved by the Interstate Commerce Commission."

This is the only provision having to do in any manner with the matter of changes of the rules, that being what is really involved in this case.*

It is the position of the defendants that this proviso in plain and unambiguous language provides how changes in the rule regarding reversing gear may be made; that neither this proviso or any of the other provisions of section 5 give the Commission any power or authority to initiate such changes, its authority in the matter being expressly stated, and as so stated being limited to approval of such changes as shall have been filed with it. It is a cardinal rule of statutory construction that where plain and unambiguous language appears in a given law, the plain and ordinary meaning thereof must control. Section 5 is, of course, only one section of this act, and the

* NOTE.—No. 157 of the original code of rules has to do with reversing gear, and reads as folows:

"157. *Reversing gear.*—Reversing gear, reverse levers, and quadrants shall be maintained in a safe and suitable condition for service. Reverse lever latch shall be so arranged that it can be easily disengaged, and provided with a spring which will keep it firmly seated in quadrant. Proper counterbalance shall be provided for the valve gear."

act should be read as a whole. When this is done, nothing will be found in any way conflicting with, or qualifying the proviso above quoted.

Section 2 prohibits the use, by any carrier, of any locomotive unless it is "in proper condition and safe to operate in the service to
272 which the same is put, that the same may be employed in the active service of such carrier without unnecessary peril to life or limb, and unless said locomotive" has been inspected and is able to withstand the tests prescribed by the law and the rules and regulations provided for.

Section 3 provides for appointment by the President, by and with the advice and consent of the Senate, of a chief inspector and two assistant chief inspectors, to have general superintendence over the district inspectors, and to see that the requirements of the law and of the rules are observed by the carriers. These appointees shall be selected with reference to their practical knowledge of the construction and repairing of locomotives, and their ability to carry into effect the provisions of the act relating to inspection and maintenance of locomotives.

Section 4 provides for the appointment of district inspectors by the Commission, to be appointed after competitive examination according to the law and rules of the Civil Service Commission. The chief inspector assigns these inspectors to the districts into which he has divided the country. The chief inspector has the duty of preparing the questions to be propounded to applicants for position of inspector, and this list of questions, upon approval of the Commission, is required to be used by the Civil Service Commission as a part of its examination of applicants.

Section 6 makes it the duty of each district inspector to be-
273 come familiar, so far as practicable, with the condition of each locomotive in his district; to make personal inspection thereof from time to time as necessary to carry out the provisions of the act; to see that the carriers themselves make inspections as required by the rules of the act, and that they repair all defects disclosed by such inspections before again placing locomotives in service. This section further provides that when a district inspector shall find any locomotive not conforming to the requirements of the law or the rules "established and approved as hereinbefore stated" he shall notify the carrier "that the locomotive is not in serviceable condition" and that it shall not be used "until in serviceable condition." Provision is made for an appeal from the decision of the district inspector to the chief inspector, and if the district inspector is upheld, the carrier may within thirty days appeal to the Commission "and upon such appeal, and after hearing, said Commission shall have power to revise, modify, or set aside such action of the chief inspector and declare that said locomotive is in serviceable condition and authorize the same to be operated."

Section 7 requires the chief inspector to make an annual report to the Commission of the work done during the year, and such recommendations for the betterment of the service, as he may desire.

Section 8 provides for reports by the carriers of accidents, and investigation thereof by the chief inspector, or his representative.

274 Section 9 provides penalties for violation of the act, or the rules, or of any lawful order of any inspector, and specifically makes it the duty of the chief inspector and of the United States attorneys, subject to the direction of the Attorney General, to enforce the act.

It will thus be seen that there is nothing in the entire act conferring upon the Interstate Commerce Commission any original jurisdiction. There is nothing which could possibly be urged as in any way tending to qualify the plain language of section 5, which limits the Commission's power with respect to the establishment of rules to that of approval, and expressly vests in the carriers the power to initiate the changes in the rules, similarly vesting in the Commission the power only of approval of same. In other words, the authority granted to the Commission by this statute is appellate in nature, and the only function it has ever had with respect to the establishment of rules or the making of changes therein, has been in the matter of approval thereof. For the Commission to assume jurisdiction to act on the complaint in this case, and to initiate and establish a change in the existing rule regarding reversing gear, or in this way to make a new or additional rule regarding same, we respectfully submit would be directly contrary to the plain provisions of this statute.

As authority for the action of the Commission in entertaining this complaint and proceeding in the manner here urged to

275 make rules under the Boiler Inspection Act, the report in Wisconsin Railroad Commission v. Aberdeen & Rockfish Railroad Company, 142 I.C.C. 199 (the Cab Curtain Case) is cited. That similar questions were raised in that case appears from the following passage on page 201 of the report:

"Certain of respondent carriers contend that we are without authority to require that locomotives and tenders be equipped with cab curtains or other parts or appurtenances, and also that if we have such power the procedure here followed is improper. Other carriers admit our authority in this regard and find no fault in the procedure followed."

The report proceeds to dispose of these questions by citing and quoting from the Supreme Court's decision in Napier v. Atlantic Coast Line, 272 U.S. 605, as authority for the Commission to specify the sort of equipment to be used on locomotives, and section 17 of the Interstate Commerce Act as authority for the method of procedure employed in that case in making the Cab Curtain Rule under the boiler inspection law. The method pursued in that case by the Commission was substantially similar to the method here proposed.

It should be borne in mind that the Commission's report in the Cab Curtain Case, is practically the proposed report written by the examiner. Exceptions to the proposed report were not filed by the respondents raising the jurisdictional question in that case. Under the rules, the proposed report became the report of the Commission. The questions raised were never argued before
276 the Commission, and it would seem therefore that the defendants herein will be justified in treating these questions as ones of first impression before this body, upon which each of the individual members of the Commission will desire to be fully advised and to base his own informed and intelligent judgment.

Taking up first the Napier case, we find the question before the Court is stated in the opinion at page 607 as follows:

"The main question, which is the same in the three cases, is one of statutory construction. It is whether the Boiler Inspection Act has occupied the field of regulating locomotive equipment used on a highway of interstate commerce, so as to preclude state legislation." And at page 613 the holding of the court is stated as follows:

"We hold that state legislation is precluded, because the Boiler Inspection Act, as we construe it, was intended to occupy the field. The broad scope of the authority conferred upon the Commission leads to that conclusion. Because the standard set by the Commission must prevail, requirements by the States are precluded, however commendable or however different their purpose."

Following this holding, the opinion concludes by stating that

"If the protection now afforded by the Commission's rules is deemed inadequate, application for relief must be made to it. The Commission's power is ample. Obviously, the rules to be prescribed
277 for this purpose need not be uniform throughout the United States; or at all seasons; or for all classes of service",

and it is upon this passage of the Supreme Court's opinion apparently that complainants in this case rely to supply the obvious deficiency existing in the boiler inspection law itself as to any power on the part of this Commission to proceed in the first instance with the making and establishment of rules under the act. (See complainants' brief, pages 82–83.) They also reply upon a further passage in the opinion in the Napier case to the effect that the Commission has power, under the Boiler Act, by means of prescribing rules and regulations under the act by which fitness for service of locomotives shall be determined, to specify the sort of equipment to be used on locomotives. (See opinion, page 612.)

We respectfully submit that to give the force and breadth contended for by complainants to the portions of this opinion upon which they rely, goes far beyond anything involved in the Napier case. It is possible to follow complainants' thought in this matter only by putting out of view the issue involved and decided in that case, and by giving to the language of certain portions of the opinion wherein "the Commission" is mentioned, a literal and restricted meaning, to reach the conclusion that the learned justice who wrote

that opinion was at the same time expressly endeavoring to rewrite the locomotive inspection law. Such a line of thought, we
278 submit, does violence to several fundamental principles which cannot be ignored. In the first place, the Supreme Court could not, if it wished, thus rewrite or amend the boiler inspection law, and in the second place it can be taken as a certainty that the Supreme Court did not, and does not wish to do so for it has always carefully refrained from invading the province of the legistlature. These matters are too well known to require citation of authority, but numerous decisions of the Supreme Court will be found from the beginning of its activity down to the present time supporting same.

An equally fundamental principle of law is that a court's opinion is authority only upon the question decided in the case in which that opinion was filed. Bearing in mind that the question before the court in the Napier case, and the question decided by the court, was whether or not by the adoption of the boiler inspection law Congress had entered the field of legislation (the entire locomotive and tender and all parts and appurtenances thereof) which would be invaded by the States if affect were given to the State laws, requiring cab curtains and automatic fire doors, it then becomes at once apparent that the case cannot legitimately be cited as authority sustaining the right of this Commission to initiate and establish changes in existing rules under the act. A reading of the entire opinion in the Napier case makes it perfectly clear that the writer of that opinion had no question in mind as to the method or manner of establishing rules
279 under the Boiler Inspection Act. What he very obviously had in mind was the very broad question of jurisdiction, as between the Federal Government on the one hand, and the States on the other, over the general subject matter of the Federal act, viz: the entire locomotive and tender and all parts and appurtenances thereof.

It is true that in referring to the general scope of the Federal act the opinion states: "The duty of the Commission is not merely to inspect. It is, also, to prescribe the rules and regulations by which fitness for service shall be determined. Unless these rules and regulations are complied with, the engine is not 'in proper condition' for operation. Thus the Commission sets the standard. By setting the standard it imposes requirements." And all the way through the remainder of the opinion the powers granted by Congress under the Federal act are referred to as "delegated to the Commission", "the broad scope of the authority conferred upon the Commission", and "the Commission's power is ample." The first expression regarding the Commission's power to inspect is, of course, not literally true because under the act the chief inspector, his assistants and the district inspectors, have all the duties and powers of inspection, the Commission itself having none. Neither does the Boiler Inspection Act give the Commission any power to prescribe, establish, or initiate the making of rules, although the making and establishment of all rules and changes therein are in a sense "prescribed" by the

280 Commission, in the sense that the act expressly provides that same shall not become effective until "approved" by the Commission. Very evidently this is the sense in which these expressions are used in the Supreme Court's decision, and we submit that to place any other construction or meaning upon the words used in the Supreme Court's opinion referred to, is entirely unwarranted, illogical and unlawful.

It is interesting to observe that the views held by the respondents in this matter were held and put forth by learned counsel on behalf of the Government in New York Central Railroad Company v. United States of America and Interstate Commerce Commission, in equity no. 226, and unreported case which was before the United States District Court for the District of Indiana, just prior to the period of Federal control. The New York Central in that case filed a bill to enjoin enforcement of the Commission's order of December 26, 1916, having to do with locomotive headlights. Before the case was finally disposed of by the court, the railroads came under Federal control, and the director general issued an order requiring installation of electric headlights, and the carrier dismissed its bill. Prior thereto a motion was filed on behalf of the defendants to dismiss the bill and a printed brief filed in support thereof. In that brief the first point is stated as follows:

"The Boiler Inspection Act is not an amendment to the act to regulate commerce, but is similar to and modeled on other
281 statutes under which Government officers or departments are authorized to prescribe rules and regulations covering a particular subject which the Government has power to control, and to enforce the same."

In developing that point, the brief goes on to state:

"The Boiler Inspection Act is independent of the act to regulate commerce and dependent upon itself alone. It carries its own penalties for offenses against its provisions, provides the procedure for the enforcement of penalties, and designates the officers to institute prosecutions."

Then follows an analysis of the boiler inspection law, followed by this statement:

"Authority is first given to the carrier to file rules and instructions. The Commission is given authority to approve its action. If the carrier fails to act, then authority is given to the chief inspector to file rules and instructions. The Commission is also given authority to approve his action. In this instance the bill sets forth (p. 11) the order of the Commission which refers to 'the rules and instructions for inspection and testing of steam locomotives and tenders, as submitted by the chief inspector and referred to in the order of the Commission dated October 11, 1915.'

"There are numerous acts on which the Boiler Inspection Act was modeled which provide their own machinery for enforcing compliance with their terms.

"With the single exception of the Hours of Service Act, all of these acts, while passed in pursuance of the power of Congress to

regulate commerce, are entirely apart from and independent of the general act to regulate commerce."

282 Again on pages 11, 12, and 13 of that brief, the matter of the Commission's authority to issue orders under the boiler inspection law was referred to as follows:

"In Baltimore & Ohio Railroad Co. v. I.C.C. (221 U.S. 612) the Commission entered an order which required the carrier to make monthly reports, under oath, under the Hours of Service Act (34 Stat., 1415), showing the instances where employees subject to that act had been on duty for a longer period than that allowed. Section 4 of that act provided:

"'It shall be the duty of the Interstate Commerce Commission to execute and enforce the provisions of this act, and all powers granted to the Interstate Commerce Commission are hereby extended to it in the execution of this act.'

"In holding that the court had jurisdiction to determine the validity of the order, the Supreme Court held that the Congress had read the entire act to regulate commerce into the Hours of Service Act, and that the Commission had authority to call for the reports under section 20 of the former act.

"The Hours of Service Act was approved March 4, 1907. The Boiler Inspection Act was approved February 17, 1911, or less than four years later. The latter contains no provision similar to section 4 of the Hours of Service Act. If the Congress had intended that in approving rules and instructions under the Boiler Inspection Act the Commission should have the power and authority conferred upon it by the act to regulate commerce, it would have been a simple course to have enacted in the Boiler Inspection Act a clause similar to section 4 of the Hours of Service Act. At is did not do

283 so, it is safe to assume that it did not intend that under the Boiler Inspection Act the Commission should have power to enter orders in pursuance of the act to regulate commerce."

These observations of the eminent counsel for the Government on this subject, we hold to be pertinent here, believing as we do that the Boiler Inspection Act is an independent act, and that in proceeding to deal with a subject matter wherein the only power of the Commission is that granted under the Boiler Inspection Act, the Commission is necessarily restricted to such power and authority as can be found in that act, and may not revert to the Interstate Commerce Act, or any other act, in order to piece out its authority.

This position we understand to be thoroughly in accord with a long line of decisions of this Commission, reference to which may be found in volume 3, Interstate Commerce Acts, annotated, at pages 1736 and 7. The general rule of these decisions is there stated to the effect that the Commission has only such authority as is prescribed in the act. To the cases cited thereunder might be added the Five Percent Case, 32 I.C.C. 325, 329, in which the report of the Commission said: "Our powers and functions are those, and only those, conferred by Congress." Referring further to the digest, page 1736,

we find the rule stated that "When the authority of the Commission as an administrative body is invoked by complaint filed, it must
284 determine whether the subject matter is within its jurisdiction before it may consider the merits of the controversy; affirmative relief may be granted only if jurisdiction over the subject matter is definitely ascertained", and on the following page reference is made to the case of Chandler Cotton Oil Co. v. Fort Smith & W. R. Co., 13 I.C.C. 473, in which it is stated:

"This complaint has not been heard, and the jurisdictional question has not been raised by the parties, but the Commission is a statutory tribunal with limited powers, and can exercise only the powers conferred in the statute. In all controversies before it if there is lack of jurisdiction, whether from absence of essential facts or through want of power in the statute, it is the duty of the Commission, of it own motion, to deny jurisdiction. This question it is bound to ask and answer for itself, even when not otherwise suggested, and without respect to the relation of the parties. This rule applies to all tribunals of limited power. Mansfield, Coldwater & Lake Michigan Railway Company *v.* Swan, 111 U.S. 382, 28 L. ed. 463, 4, Sup. Ct. Rep. 510."

Referring again to the reference to section 17 of the act, which is found in the Commission's opinion in the Cab Curtain case and is quoted on sheet 5 of the proposed report in this case, we contend and firmly believe that there is no warrant in law for the Commission in this proceeding to refer to section 17, or any other section or provision of the Interstate Commerce Act, as authority for it to proceed upon the complaint in this case to exercise an alleged
284 power or function under the boiler inspection law, which has not been conferred upon the Commission by the plain provisions of that law.

Upon the questions raised as to the Commission's jurisdiction in this matter, we therefore request that the Commission find that it is without jurisdiction to entertain the complaint, and that the same should be dismissed.

In view of the importance of this case, the large number of defendants and extremely heavy cost involved, we respectfully request that the privilege of oral argument before the whole Commission be extended.

Respectfully submitted.

J. N. Davis, Thos. L. Ennis, A. L. Janes, W. J. Larabee, Eldon M. Martin, Walter McFarland, John W. Murphy, M. B. Pierce, Dana T. Smith, Arthur Van Meter, Toll R. Ware, Joseph H. Wright, Sidney S. Alderman, H. Z. Maxwell, Alfred P. Thom, Jr., Nye F. Morehouse, Counsel for said Respondents.

ALFRED P. THOM,
*Of Counsel.*

285 WASHINGTON, D.C., *April 15, 1932.*

286 *Plaintiff's exhibit no. 4*

[File endorsement omitted.]

I, George B. McGinty, Secretary of the Interstate Commerce Commission, do hereby certify that the attached is a true copy of report proposed by Examiner John L. Rogers, in case no. 24050, A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers, et al. v. Atlantic Coast Line Railroad Company, et al., the original of which is now on file and of record in the office of this Commission.

In witness whereof I have hereunto set my hand and affixed the seal of said Commission this 17th day of June, A.D. 1933.

[SEAL] GEORGE B. MCGINTY,
*Secretary of the Interstate Commerce Commission.*

287 Interstate Commerce Commission

No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS, et al.

*v.*

ATLANTIC COAST LINE RAILROAD COMPANY, ET AL.

The safety of employees and travelers upon railroads requires that steam locomotives used in road service having a weight in working order of 150,000 pounds or more on driving wheels and locomotives used in yard service having a weight in working order of 130,000 pounds or more on driving wheels be equipped with power reverse gear. Recommended that appropriate rules be approved and established.

H. N. McLaughlin, Oscar J. Horn, G. W. Laughlin, Thomas Stevenson, and Timothy Shea for complainants.

W. W. Ahrens, Sidney G. Alderman, B. F. Batts, W. S. Bronson, Ben B. Cain, Willis Crane, Fayette B. Dow, Harry P. Elkins, Thomas L. Ennis, Henry J. Hart, William J. Kane, W. J. Larabee, R. A. McCarran, Harry Z. Maxwell, Clarence A. Miller, Nye F. Morehouse, John W. Murphy, Robert E. Quirk, M. G. Roberts, William B. Rodman, J. R. Skillman, Dana T. Smith, Alfred P. Thom, Alfred P. Thom, Jr., D. W. Thomas, Arthur Van Meter, and Toll R. Ware for defendants.

A. R. McDonald for intervener.

REPORT PROPOSED BY JOHN L. ROGERS, EXAMINER

By complaint filed by A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen,

it is alleged in substance, that defendant carriers are using steam locomotives which are not in proper condition and safe to operate in the service to which the same are put, and without being so equipped that they may be used without unnecessary peril to life or limb, in violation of the Boiler Inspection Act, as amended. These conditions arise, it is alleged, because the locomotives are equipped with manually-operated reverse gear, instead of power-operated reverse gear. The Commission is asked to require defendant carriers to equip their steam locomotives with reverse gear operated by power, or other devices adequate to protect
288 the employees thereon from unnecessary peril to life or limb.

The Railroad Commission of Wisconsin intervened in support of the complaint.

It will be understood that throughout this report we are dealing only with steam locomotives as distinguished from locomotives propelled by power other than steam.

The valve gear of a steam locomotive consists of eccentrics, or eccentric cranks, rods, links, rockers, etc., by means of which the valves which control the admission of steam into the cylinders are moved, and their motion regulated. The valve gear is so arranged that the locomotive can be run either forward or backward, and so that the direction of motion of the wheels can be reversed as desired. It enables the engineer to work the locomotive at capacity by admitting steam into the cylinders during the whole or nearly the whole of the stroke of the pistons, or, when less power is required, to use the steam more economically by admitting steam into the cylinders during a portion of the stroke and working it expansively during the remainder of the stroke of the pistons. There are five types of valve gear in general use, i.e., Stephenson, Walschaert, Baker, Young, and Southern. It is not necessary for present purposes to describe in detail the construction and operation of the various types of valve gear. The Stephenson type has been longest in use, but modern locomotives are usually equipped with one of the other types. The two types of valves in general use are usually referred to as slide valves and piston valves.

The reverse gear is the mechanism by means of which the direction of movement of a locomotive is reversed. The manually operated reverse lever is a lever pivoted to the frame, or the foot plate, and connected by means of the reach rod and reverse arm to the
289 link of the valve gear for moving the link, or link block, and thereby reversing the motion of the engine or causing the valves to cut off the admission of steam at any desired point in the stroke. The hand reverse lever is arranged to move along a notched sector or quadrant, in any one of such notches it can be latched. On some locomotives the reach rod is moved by means of a screw, with an operating wheel connected therewith. The reverse lever or wheel is located in the cab and is operated by the person running the locomotive.

The power reverse gear sought by complainants performs the same functions as the manually operated gear, but through the use of cylinders and rods the mechanism is moved by power, usually compressed air, instead of by hand. The trade names of the principal power reverse gears are Alco, Ragonnet, Precision, Franklin, and Barco.

When locomotives are equipped with hand reverse gear any derangement of the valve motion is communicated to the reverse lever in the cab through lifting shaft and reach rod. But when a power reverse gear is used the reach rod terminates at the power reverse gear, and the only connection to the cab is the rod connecting the reverse gear operating lever with the valve located at the reverse gear which admits air to the reverse gear cylinder.

There are now reported to the Commission a total of 60,522 steam locomotives which are subject to the Boiler Inspection Act, as amended. The record shows the kind of reverse gear on 57,541 of these locomotives. Of the latter, a total of 27,503 locomotives are equipped with power reverse gear and 30,038 locomotives are equipped with hand reverse gear. Applying this proportion to the 60,522 locomotives for which reports are being received it may be said with reasonable accuracy that of the total locomotives subject to the Boiler Inspection Act, as amended, 28,925 are equipped with power reverse gear and 31,597 are equipped with hand reverse gear.

290 The request of complainants is that the Commission require the carriers to equip all of these 31,597 locomotives with power reverse gear. Certain of defendant carriers contend that the Commission is without authority to require that locomotives be equipped with power reverse gear, and also that if we have such power the procedure here followed is improper. A similar view was considered by the Commission in Wisconsin R.R. Commission v. A. & R. R.R. Co., 142 I.C.C. 199. There the Commission said:

"Our authority to specify the sort of equipment to be used on locomotives was considered by the Supreme Court of the United States in Napier v. Atlantic Coast Line, 272 U.S. 605. There the court said:

"'The requirements here in question are in their nature, within the scope of the authority delegated to the Commission. An automatic firedoor and an effective cab curtain may promote safety. Keeping firemen and engineers in good health, like preventing excessive fatigue through limiting the hours of service, clearly does so, although indirectly; and it may be found that to promote their comfort would likewise promote safety. It is argued that the authority delegated to the Commission does not extend to ordering the use or installation of equipment of any kind, Baltimore & Ohio R.R. Co. v. Groeger, 266 U.S. 521, and that Congress has definitely reserved that power to itself, Interstate Commerce Commission v. Cincinnati, New Orleans & Texas Pacific Ry. Co., 167 U.S. 479; Atlantic Coast Line R.R. Co. v. Georgia, 234 U.S. 280; United States v. Pennsylvania R.R. Co., 242 U.S. 208. The question whether the

Boiler Inspection Act confers upon the Interstate Commerce Commission power to specify the sort of equipment to be used on locomotives was left open in Vandalia R.R. Co. v. Public Service Commission, 242 U.S. 255. We think that power was conferred. The duty of the Commission is not merely to inspect. It is also to prescribe the rules and regulations by which fitness for service shall be determined. Unless these rules and regulations are complied with, the engine is not "in proper condition" for operation. Thus the Commission sets the standard. By setting the standard it imposes requirements.'

"The court further said:

"'If the protection now afforded by the Commission's rules is deemed inadequate, application for relief must be made to it. The Commission's power is ample.

291 "'The procedure to be followed by us in considering applications for relief not afforded by the rules and regulations already prescribed, as referred to by the court is not specified. Section 17 of the Interstate Commerce Act provides, "that the Commission may conduct its proceedings in such manner as will best conduce to the proper dispatch of business and to the ends of justice." Copies of the complaint and intervening petitions were duly served upon respondents. Answers were filed by respondents. Afterwards the matter was assigned for hearing in various parts of the territory involved, thereby affording all interested parties full opportunity to be heard. The carriers were invited to suggest rules which we might consider in the event that it was determined that some rules were necessary. Opportunity was also given to file briefs and for oral argument.

"'While some of the carriers criticized the procedure followed, all agreed that it was as fair and equitable as could be provided and suggested no procedure which would better conduce to the proper dispatch of business and to the ends of justice although requested so to do.'"

As a result of that proceeding the Commission by order of May 7, 1928, amended the rules and instructions for the inspection and testing steam locomotives by adding thereto rules requiring that in certain territory and during a specified period of the year steam locomotives shall be equipped with cab curtains, storm windows, and certain other equipment. These requirements became effective on November 1, 1928, and have been met by the carriers.

The Commission again exercised the authority to require the installation of additional equipment on locomotives in Public Utilities Commission of Ohio v. Pennsylvania R. Co., 151 I.C.C. 448. There the Commission found that the safety of employees and travelers upon railroads requires that steam locomotives, except locomotives using oil fuel, have mechanically operated firedoors, and entered an order amending the rules so as to require the installation of mechanically operated firedoors. This order became fully effective

on July 1, 1931, and the Commission's power to make such an order was not questioned nor was the procedure questioned.

292 As pointed out by the Supreme Court in Napier v. Atlantic Coast Line, supra, the Commission has from time to time since the passage of the original act, required that locomotives used in interstate commerce be equipped with various devices.

In the present case copies of the complaint and intervening petition were duly served upon defendant carrier. Answers were filed by the majority of the carriers involved. Afterwards the matter was assigned for hearing in various parts of the country in accordance with the desires and for the convenience of defendants, thereby affording all interested parties full opportunity to be heard. A total of 337 witnesses were heard and their testimony covered 6,491 pages. In addition 109 exhibits were received in evidence. Of the witnesses, 74 testified on behalf of complainants and 263 on behalf of defendants. The testimony on behalf of complainants covered 1,668 pages, and on behalf of defendants covered 4,823 pages. Every witness presented by the parties was heard and opportunity afforded the opposing parties for proper cross-examination. A total of 55 days were devoted to taking of testimony. The parties were invited to suggest rules which the Commission might consider in the event that any rule was deemed necessary. Elaborate briefs were filed and a proposed report was issued by the examiner. Opportunity was afforded for filing of exceptions to the proposed report and for oral argument before the Commission.

The Supreme Court held in Napier v. Atlantic Coast Line, supra, that the Commission's power is ample to require for the promotion of safety that additional equipment be installed on locomotives used in interstate commerce, and that " if the protection now afforded by the Commission's rules is deemed inadequate, application for relief must be made to it." Obviously the court was here referring

293 to application for relief by the employees of the carriers or on behalf of the traveling public because occasion would not arise for the carriers to apply to the Commission in order to install additional equipment on their locomotives. This is made clear by consideration of the fact that the carriers have applied, without any application to or authority from the Commission, power reverse gear on 28,925 locomotives and it is this equipment which complainants contend should be applied on the remaining locomotives. The Court said that application for relief must be made to the Commission. The application for relief in this case was filed directly with the Commission and it has followed the procedure previously outlined herein in order to fully develop the facts upon which to base its judgment as to whether the request of complainants should be met on any or all steam locomotives. The procedure followed in this case has been employed by the Commission in the consideration of thousands of cases. The procedure to be followed is not specified in the Boiler Inspection Act and defendant carriers are in no position to criticize the procedure which was employed,

at least until they have suggested other procedure which will better "conduce to the proper dispatch of business and the ends of justice."

Upon brief counsel representing most of the class 1 carriers request that the Commission postpone its decision as to the procedural question until the issues involved in docket no. 24049, dealing with the application of mechanical stokers, are presented for determination. This request should be denied for the reason that the Commission has already passed upon this question (see Wisconsin R.R. Commission v. A. & R. R.R. Co., supra) and for the further reason that if there is anything wrong with the procedure followed in the present case the error should be now definitely determined so that
294 it can be corrected before spending the time and money which will be involved in the hearing and consideration of any other similar proceeding brought under this law.

Steam locomotives consist of a boiler and engine mounted on a frame supported by wheels which are turned by the engine. The boiler contains water and has a firebox forming part of it in which fuel is burned to supply heat to the water and convert it into steam. The steam passes through the throttle valve, thence through pipes to the steam chests, in which valves operated by various forms of valve gear, as previously mentioned, automatically admit it alternately to each end of the cylinders and exhaust it therefrom into the atmosphere through the exhaust pipes and stack. The force of the steam moves the pistons, piston rods, and crossheads back and forth, and, as the crosshead, moves in the guides, and has one end of the main rod connected to it by the wrist pin, while the other end of the main rod is connected to the crank pin on the driving wheel, reciprocating motion of the piston is thereby changed into the rotary motion of the driving wheels.

The valve gear is the mechanism by means of which the slide valves or piston valves are operated for the purpose of admitting steam to and exhausting it from locomotive cylinders. Valve gears are so arranged as to allow steam to be cut off at any desired point in the stroke of the piston, and admit steam to either end of the cylinders in order to run the locomotive either forward or backward. The ordinary link motion or so-called Stephenson link motion uses two eccentrics for each valve, the eccentric rods imparting motion to a link having a sliding block to which one end of a rocker arm is connected. The other arm of this rocker is connected to and thus moves the valve rod and valve. The point of cut-off as well as the direction in which the engine turns the wheels is determined by the position of the link block and rocker pin in the link. The
295 link is suspended by a link lifter attached to an arm on the reverse shaft. When this shaft is turned by the operation of the reverse lever, reach rod and reverse shaft arms, the link is raised or lowered, thereby moving the link block and rocker pin either forward or backward and consequently causing the valve to move on its seat.

The Baker valve gear gets its motion from two points, the eccentric crank and the crosshead. The eccentric crank moves the radius bar and the action the radius bar has on the valve is controlled by the reverse yoke. The radius bar and yoke takes the place of the link and block of a link motion, such as described above, and the crosshead moves the valve the amount of the lap and lead each way.

The Walschaert and other types of valve gear are constructed somewhat differently, having some parts in addition to those referred to under the Stephenson and Baker gears but eliminating others. Regardless of type every valve gear is adjusted to the desired position by the reverse gear. Other parts of the reverse gear are moved by the reach rod. The reach rod is connected to the reverse lever in the cab when the locomotive is equipped with hand-operated reverse gear, and is connected to the crosshead or equivalent part of power reverse gear on locomotives so equipped.

On locomotives equipped with hand-operated reverse gear the engineer, or other person operating the locomotive, moves the reach rod and other parts of the reverse gear, as well as the valve gear, by moving the reverse lever in the cab. Some locomotives are equipped with a screw and wheel connected therewith for the purpose of moving the reach rod, the wheel being turned by hand.

On locomotives equipped with power reverse gear the reach rod is moved by power derived from an air cylinder and piston, or equivalent mechanism operated by compressed air, the engi-
296 neer merely moving the valve, which controls the flow of air, by means of a small lever or wheel in the cab.

The general arrangement of parts on a locomotive equipped with hand reverse gear is shown by figure 1. Figure 2 shows for comparison a typical general arrangement of parts on a locomotive equipped with power reverse gear.

Friction between certain parts of the reverse gear, valve gear, and between parts of the valve and steam chest, as well as the weight of the parts not counterbalanced, or which may be counterbalanced, makes it necessary that considerable force be exerted in order to move the reverse gear. The force required is increased if there is steam in the steam chests and cylinders, and varies also with speed and with the tractive effort being developed by the locomotive, and because of several other conditions which arise in practical operation. On a locomotive equipped with hand reverse gear whatever force is necessary to move the reverse lever must be exerted by the person operating the locomotive. On a locomotive equipped with power reverse gear the necessary force is exerted by air or steam pressure, the person operating the locomotive merely operating the valve which controls the flow of air or steam.

The cab of a locomotive is a shelter built of wood or sheet steel, usually enclosing the back end of the boiler, for the protection of the enginemen. On a relatively few locomotives having very broad fireboxes, two cabs are used; one for the engineer on the forward

part of the boiler like a saddle; the other, much smaller, to shelter the fireman at the back end of the boiler. Many devices under the direct control of the enginemen are located on or near the boiler head and within the cab. The reverse lever, or reverse operating wheel, is one of such devices and is located in the right side
297 of the cab near the engineer's seat. The hand reverse lever quadrant is a steel bar or bars forming an arc of a circle, over or along which the reverse lever moves. It is secured to the frame or deck plate or to the side of the boiler, and has notches cut in its upper surface for the reverse lever latch. The reverse lever latch is a catch having a tooth or bolt held in place by a latch box through which it passes, and forced into a notch in the quadrant by means of a spring. The latch is supposed to lock the reverse lever in any desired position along the quadrant. The distance between the reverse lever and other parts of the locomotive is herein termed reverse lever clearance.

In the operation of locomotives many engineers, as well as others, have been injured by being struck or jerked by the hand reverse lever. Such accidents have occurred under varying circumstances and conditions. Accidents have also occurred on locomotives equipped with power reverse, which defendants urge would not have occurred if the locomotives involved had been equipped with hand reverse. The Boiler Inspection Act, as amended, provides, in part, that: "It shall be unlawful for any carrier to use or permit to be used on its line any locomotive unless said locomotive, its boiler, tender, and all parts and appurtenances thereof are in proper condition and safe to operate in the service to which the same are put, that the same may be employed in the active service of such carrier without unnecessary peril to life or limb * * *."

The question of fact presented for the determination of the Commission is whether the use of locomotives equipped with hand reverse gear, as compared with power reverse gear, causes unnecessary peril to life or limb.

We shall first consider the evidence of record as to accidents in which locomotives equipped with hand reverse gear were involved, and follow with consideration of the evidence as to accidents in which locomotives equipped with power reverse gear were involved.
298 The evidence relating to accidents consists of testimony of witnesses who were injured or were on or around the locomotives when some other persons were injured, and certain reports made by the carriers to the Commission's Bureau of Statistics covering accidents on locomotives in which reverse gear was involved. The testimony of the witnesses was, in some instances, supplemented by reports covering investigation of accidents by inspectors of the Commission pursuant to the provisions of the boiler inspection law.

A number of witnesses who had been injured while operating locomotives equipped with hand reverse gear testified on behalf of complainant. This testimony is briefly summarized as follows:

1. After starting his train the engineer brought the hand reverse lever back to the working notch. It had become a habit for him to hold the reverse lever latch while running between stations. The brakeman called his attention to something and as he turned around he let go of the latch on the lever and at the same time threw his foot up on the lower end of the quadrant, at which time the latch flew out of the quadrant and the lever went to the extreme forward motion, catching his heel. The fireman took the train into the home terminal. Engineer was off duty account of accident from December 8th until the last of February.

2. Reverse lever was difficult to operate due to right link binding and reverse lever latch spring too stiff; reversing gear had been reported difficult to operate. Engineer was reversing engine to make a back-up movement and had to use all his strength, resulting in ligaments in back being torn loose. Was off duty for 133 days.

3. Locomotive was standing on curve, and when on curve it was impossible to reverse the engine. Used piece of gas pipe so as to get more leverage in attempting to reverse it, but could not do so; finally, with the help of fireman, succeeded in doing so. As a result of effort and strength expended, engineer felt sick in stomach. Was attended by the company surgeon and sent to hospital and operated on for hernia. Blood poisoning set in and had to be drained for nine weeks. Off duty from April 18th to September 3rd.

4. On account of brakemen and section men at front of engine, did not dare open cylinder cocks, and, in trying to reverse engine, foot slipped off of the foot brace. The hard pull caused a left inguinal hernia. Off duty for about 3 months.

5. The cause of the injury was the hard operation of the manually operated screw reverse. The pulling of the wheel resulted in strain on the lower part of the abdomen, which caused a hernia. Was operated on for hernia. Off duty for three months.

299 6. Reverse lever flew backward while being hooked up due to valves being out of square and reversing gear and valve gear in worn condition. Reverse lever kicked back and broke bone in engineer's left wrist. Off duty from February 7th to April 1st.

7. Throttle came open and let steam into the cylinders, could not move bar. Engineer did not know that throttle came open. Attempted to open cylinder cocks but pressure kept them from opening. Braced himself with left foot against back of cab and forced the bar over. When bar went over the center gave him a quick jerk, the latch didn't catch and as a result he tore a rib loose and also ligaments on the left side. Off duty account of injury from December 21 to January 29.

8. Studs supporting reverse gear pulled out of boiler due to valves seizing because of lack of lubrication; the engineer, fireman, and brakeman were injured. The engineer received first-degree burns about face and back bruised. Off duty due to injury about 15 days. Fireman received first-degree burns about face, right wrist burned

and left hand. Off duty about four weeks. Brakeman received first-degree burns about face. Off duty about five weeks.

9. Engine was just out of the shop and everything was new and worked so hard that it was almost impossible to reverse engine. Engineer strained hip in pulling so hard on wheel in attempting to reverse locomotive. Off duty from May 7th to August 16th account of injury.

10. While engineer and fireman were attempting to hook up reverse lever, lever moved forward suddenly, catching engineer's arm between lever and injector pipe; right arm broken at elbow. Off duty from May 5th to August 25th, 1927.

11. Insufficient clearance between reverse lever and air pipe of automatic brake valve; broken ankle, left leg. Off duty for six months.

12. In shortening the valve travel by hooking up the reverse lever lost control of it and in its movement to the front corner it struck engineer's arm, breaking both bones of right forearm. Off duty for five months.

13. Was hooking up engine and put his foot up to brace himself, gave her a pull which resulted in double hernia. Was operated on and off duty for 100 days.

14. Reverse lever became unlatched and went forcibly into full forward position catching engineer's foot between lever and triangular wooden block at front end of quadrant for use as foot brace; all teeth in reverse lever latch were badly worn and partly filled with grease and dirt; compound fracture of bones in left leg at ankle joint. Off duty for 86 days.

15. Insufficient clearance between reverse lever and back head of boiler, due to stop block missing; engineer mashed middle finger on left hand. Off duty for 14 days.

16. Started to hook up engine and braced himself with foot against boiler head, lever going into the corner and breaking his leg. Engineer has not been able to return to service up to date of hearing, May 14, 1931. Accident occurred on January 31, 1931.

300 17. The main driving journal broke and came up and struck the reach rod, throwing the reverse lever into back gear and catching engineer's leg against the back board. Left leg broken above the knee and multiple fractures at knee joint. Was laid up because of injury, six weeks in splints, ten weeks in a cast, 90 days to have it massaged and baked. Has not been able to do any work since that time.

18. Reverse lever unlatched and went suddenly to full forward position account of quadrant dropping down due to loose bracket connections, catching employee's hand between top of reverse lever and brake valve handle; quadrant was reported to be tightened on November 25 and December 2; left hand bruised between thumb and forefinger. Off duty 10 days.

19. Engine was backing up. Engineer reached to unlatch lever and push it up towards center, in doing so reverse lever jumped back

and caught hand and elbow against the cab, and sprained wrist. Off duty about 20 days on account of injury.

20. Employee in attempting to reverse locomotive got the lever half way over where it stuck and in endeavoring to pull it back caused rupture. Off duty 100 days.

21. First injury occurred on July 17, 1925, in switching service in attempting to throw lever back, wrenched back. Was off duty for 3 days. Second injury occurred on engine was just out of shop and which worked hard. In pulling hard on the reverse lever in attempting to reverse it, it came back quickly and caught his foot between the back of the cab and reverse lever. Bruised foot, did not lose any time but was lame for about 3 weeks.

22. In moving the reverse lever from forward to backward position, braced himself with foot and applied all his strength and weight in bringing the lever back. Foot slipped off of brace causing him to pitch forward. Strain caused a hernia and had to be operated upon. Off duty for a period of 30 days.

23. Valves were dry and reverse lever pounded and rattled. Engineer determined to get it out of the corner and braced foot on boiler head and pulled with all his strength, got it half-way back when he found could not hold it. Foot slipped off the boiler and was pinched between the reverse lever latch and air pipe. Off duty about 6 days account of injury.

24. Fireman was assisting engineer in hooking up locomotive. Lever got away and went into the corner; fireman saw that engineer could not get engine out. He stepped over to help pull on lever and in doing so strained his back. Off duty 58 days on account of injury.

25. In hooking up engine caught foot between reverse lever and the boiler head. Left foot broken and badly cut. Off duty for 7 months.

26. Reverse lever counter-balance spring failed while engine was being reversed; spring band showed old fracture. Engineer's neck muscles and cord bruised. Off duty approximately 20 days.

27. Insufficient clearance between reverse lever and sander pipe on boiler had; stop pin missing from forward end of quadrant. End of engineer's middle finger on left hand crushed and the bone broken. Off duty for six weeks.

301 28. Valve ring broke and caught in port, forcing reverse lever back violently. Left side of chest bruised by being struck by reverse lever. Off duty on account of injury for 19 days.

29. In taking slack out of train engineer opened throttle but engine did not move. Closed throttle and tried to reverse engine but unable to do so. Braced himself and applied all his strength, hand slipped over top of reverse lever and he fell backwards. Resistance to pull was due to the large amount of steam in cylinders. Injury was a slipped vertebra and displacement of wedge-shaped bone in the hip. Off duty for a period of 9 days.

30. Engine was working water. Reverse lever was in forward motion. Engineer endeavored to reverse it and due to hard working

of engine strained muscles in arm and shoulder. Was off duty for 5 days.

31. While switching at gravel pit in making a reverse movement in back-up position, engineer pulled the reverse lever back to end of quadrant and strained the muscles or ligaments in back. Off duty for a period of 15 days.

32. Reverse lever went to full back position allowing the valve to over-travel and catch broken exhaust ring on the end of valve chamber bushing, causing the gear to reverse and throw engineer forward then backward with great force. Cut on right side of head, cut on right knee, right arm broken below elbow, both bones. Left arm broken above elbow. Left leg broken above ankle, both bones. Off duty indefinitely. Has not worked in railroad service since accident, which occurred in April 1928.

33. Injured while operating reverse lever; right valve and valve seat were cut and left valve yoke fitted too tight on valve, causing reverse lever to be difficult to operate. From pulling on reverse lever strained abdomen, the muscles and ligaments were pulled loose from the pelvic bone. Off duty 16 days.

34. Engineer was not able to reverse engine. It was necessary to take the slack. Fireman braced his foot against the boiler head and put the engine in back motion and in doing so ruptured himself on right side. Off duty for 14 days.

35. Engineer had taken slack and backed up; braced himself on the floor of the cab to throw the engine ahead and in doing so tore all the ligaments and cartilage along right knee. Off duty for four months.

36. In coupling cars engineer tried to get the reverse lever over after making the coupling, got the lever up about two notches in the quadrant and it stuck. Lunged at it and could not get it over, got behind it and shoved it until it got to the center. The effort expended in shoving the lever over resulted in a hernia, necessitating an operation. Off duty for about 50 days.

37. Front hanger to right front driving spring broke and spring fell with one end under eccentric blade which caused reverse lever to release. Engineer suffered compound fracture of left knee cap with injury to synovial member of knee joint. Off duty for 3 months.

302 38. Driving wheel spring equalizer post broke, permitting spring to drop on eccentric straps and cause reverse lever to unlatch and move back unexpectedly. Lever flew back and hit engineer in left side, causing hernia. Off duty for 91 days.

39. Valve strip fouled on a plug which worked out of pressure plate, breaking rocker box, valve yoke, and throwing reverse lever back suddenly. Lever went back into the corner, severely bruising engineer's left knee. Off duty for 25 days.

40. While engineer was trying to get reverse lever in forward motion, it jerked away and against the boiler, striking hand against

drain pipe or gauge cocks. Knuckles cut open and caused lacerations and concussion of the back of the hand. Off duty for 32 days account of injury.

Of 233 accidents reported by the carriers to the Commission's Bureau of Statistics during the calendar years 1929 and 1930, as having occurred in the operation of, or due to the action of reversing gear, a total of 216 occurred on locomotives equipped with hand reverse gear and 16 on locomotives equipped with power reverse gear. The facts regarding these accidents, as stated in the reports, are briefly set out in the following:

Hand reverse gear

1. Engineer strained his side working reverse lever. Accident probably caused by the position engineer was in when he tried to operate reverse lever. Actual disability 12 days.

2. While reversing engine, engineer struck his elbow against cab. Arm became infected. Actual disability 21 days.

3. While reversing engine, engineer struck his elbow back of the cab, causing it to be jammed against handle and reverse bar, resulting in a sprain and bruises of elbow and wrist. Probable disability of 14 days.

4. Engineer threw the weight of his body against bar while reversing engine causing contusion of left chest. Actual disability 7 days.

5. Fireman badly bruised elbow while working reverse lever. Left hand slipped off reverse lever causing elbow to strike in corner of cab. Probable disability 40 days.

6. Engineer strained his back working reverse lever. Accident caused by reverse bar working hard and steam in cylinders. When throwing reverse bar back, turned his body in a twist to the left. Probable disability 30 days.

7. Engineer braced himself by placing right foot on straight air pipe to operate reverse lever. In pulling on bar he sprained his leg. Actual disability 24 days.

303 8. Engineer strained his back working reverse lever. Reverse lever worked very stiff due to cold weather, causing engineer to give hard jerk on lever. Actual disability 7 days.

9. While reversing engine engineer's hand slipped resulting in an injured thumb. Injury due to proper precaution not being taken. Actual disability 5 days.

10. Engineer strained muscles of left side while attempting to reverse engine. Exerted too much strength in the effort. Actual disability 7 days.

11. Engineer strained right groin and upper right leg. Accident caused by exerting too much strength in jerking on reverse gear while attempting to reverse engine on ready track. Actual disability 12 days.

12. Engineer strained private parts (traumatic orchitis). Attempted to reverse engine and failed. Placed right foot against steam pipe to brace himself. Actual disability 13 days.

13. Engineer sprained his back. Went to reverse engine, and while putting bar back, slipped and fell back. Actual disability 5 days.

14. While reversing engine engineer wrenched his arm, resulting in slipped tendon in right shoulder. Actual disability 17 days.

15. Engineer strained his back while operating reverse lever. Probable disability 84 days.

16. While operating reverse lever, engineer strained his right side and shoulder, resulting in traumatic arthritis. Probable disability 60 days.

17. Engineer sprained ligaments in left hip. Reverse lever stuck in extreme forward end of reverse lever quadrant. Accident caused by attempting to pull lever out. Actual disability 16 days.

18. While operating reverse lever engineer strained muscles of back. Accident caused by operating reverse lever without first letting steam out of cylinders. Actual disability 7 days.

19. While operating reverse lever engineer strained back. Accident caused by reverse lever handling hard. Actual disability 17 days.

20. Hostler while operating reverse lever strained his chest. Reverse lever worked quite hard. Accident caused by giving extra hard pull. Actual disability 7 days.

21. While operating reverse lever engineer bruised left side and leg. Accident caused by foot slipping throwing engineer against lever. Probable disability 30 days.

22. While reversing engine engineer dislocated vertebrae in spine While pulling on lever. Probable disability 10 days.

304 23. While reversing engine engineer strained side. Throttle had eased open letting steam in cylinder making engine hard to reverse. Probable disability 4 days.

24. Engineer strained left elbow while attempting to pull reverse lever back. Probable disability 17 days.

25. While reversing engine engineer struck arm against blow-off valve lever in cab, resulting in transverse fracture tip oleocranon process right ulna. Actual disability 38 days.

26. While reversing engineer strained tendon back of left leg. Accident caused while trying to reverse engine from back to forward. Probable disability 14 days.

27. Engineer strained his back. Accident happened while trying to pull back reverse lever. Probable disability, 10 days.

28. Engineer sprained back. Accident occurred while throwing reverse lever. Actual disability 14 days.

29. Fireman strained back helping engineer throw reverse lever. Reverse lever would not move account snow and ice. Probable disability 7 days.

30. While adjusting reverse lever, train in motion, engineer caught his arm between lever and front wall of cab. Right forearm strained and right elbow bruised. Actual disability 9 days.

31. Engineer fractured second and third metatarsal bones in foot letting reverse lever down. Lever jerked out of his hands account valve being dry, caught foot which had slipped off boiler head, between lever and train line pipe. Actual disability 30 days.

32. Engineer injured his foot. While attempting to "hook up" engine reverse lever jerked to forward end of quadrant catching foot between lever and air pipe on back of boiler. Probable disability 90 days.

33. Engineer's foot injured. Amputation of four toes, left foot. Engineer failed to set independent brake before instructing fireman to move reverse lever. Foot caught between eccentric arm and crank arm. Disability permanent.

34. Engineer's foot injured. Fracture of right great toe. Engineer intended to drop reverse lever a notch, slipped out of his hands, went into corner catching his foot. Probable disability 21 days.

35. While pushing reverse lever ahead engineer's foot slipped off step at quadrant straining ligaments in abdomen and side. Actual disability 4 days.

36. While reversing engine engineer strained his back. Accident occurred while rerailing engine and snow plow. Actual disability 10 days.

37. While reversing engine engineer injured left foot. Reverse lever got away from engineer going into corner catching his foot which he had placed against boiler to brace himself. Actual disability 7 days.

305 38. While reversing engine, engineer strained right shoulder. Actual disability 13 days.

39. While helping to reverse engine, fireman strained back. Lever threw hard account extreme cold weather and frost on valve gear parts. Actual disability 9 days.

40. While helping engineer reverse engine, fireman injures nose. Throttle flew open striking fireman on nose. Engine stuck in snow. Actual disability 6 days.

41. While operating reverse lever, engineer suffers hernia, right side. Probable disability 60 days.

42. While operating reverse lever, engineer injured left foot. Foot caught between lever and boiler head. Probable disability 30 days.

43. While reversing engine to take slack, engineer injured shin bone on right leg. Foot slipped while pulling or pushing on lever, striking lever latch. Actual disability 12 days.

44. While operating reverse lever, engineer suffered broken large toe, right foot. Reverse lever pulled down to full forward position catching foot, inside arm to reach rod carrier broken off and missing—roller and bolt which retains roller in reach rod guide missing. Probable disability 60 days.

45. While operating reverse lever, engineer struck elbow against backboard, spraining cords in left hand. Actual disability 12 days.

46. While reversing engine, engineer strained right side. Engineer's foot slipped, causing strain. Actual disability 12 days.

47. Engineer's side bruised. While switching, engineer pulled throttle out, reverse lever came down, striking him as he was looking back for signal. Actual disability 15 days.

48. Engineer's right groin strained. While reversing engine, engineer slipped and fell back against backboard of cab. Actual disability 10 days.

49. Engineer's left side bruised. While running engine, engineer took hold of reverse lever which slipped out of his hand, and he struck against end of throttle. Actual disability 8 days.

50. While assisting in reversing engine, fireman bumped thumb on reverse lever, injuring same. Bruise became infected. Actual disability 31 days.

51. Fireman suffered a strained abdomen assisting engineer in reversing engine. Actual disability 12 days.

52. While reversing engine, engineer strained muscles of back and arms. Actual disability 13 days.

53. While operating reverse lever, fireman dislocated thumb. In throwing reverse lever thumb caught in back curtain. Actual disability 4 days.

306 54. While reversing engine, engineer sprained back. Actual disability 6 days.

55. While reversing engine, engineer sprained left wrist. Actual disability 24 days.

56. While operating reverse lever engineer bruised left foot and little toe broken. Foot caught between lever and quadrant support, account placing foot on running board at back end of quadrant just ahead of quadrant support. Actual disability 5 days.

57. While reversing engine, engineer sprained back. Actual disability 15 days.

58. While assisting in reversing engine, fireman sprained back, account his foot slipping. Actual disability 14 days.

59. While reversing engine, engineer bruised toes which became infected. Foot caught between reverse lever and floor of cab. Actual disability 14 days.

60. Engineer fractured small bone in ankle, while attempting to move lever up a notch. Engineer braced foot against gauge cock drain pipe, lever slipped from his hand and went forward, foot slipped off pipe and struck by reverse. Probably disability 40 days.

61. Engineer injured lower left abdomen. Thrown against reverse lever, account impact caused by switching. Probable disability 30 days.

62. While moving reverse lever back and forth engineer strained muscles of right groin. Emergency brakes set and would not release. Engineer had to move lever against steam. Actual disability 20 days.

63. While operating reverse lever, engineer suffered contusion back left hand. When throwing reverse lever forward, it jerked engineer forward and his hand struck boiler head. Actual disability 32 days.

64. While reversing engine, engineer suffered injury to left wrist. Accident caused by counterbalance spring being not properly set. Lever went back and caught left hand against backboard in cab. Actual disability 10 days.

65. While assisting to reverse engine, fireman sprained back. Actual disability 5 days.

66. While operating reverse lever, engineer sprained right side. Actual disability 15 days.

67. While operating reverse lever, engineer sprained right hip. Actual disability 17 days.

68. While operating reverse lever, engineer sprained back. Actual disability 9 days.

69. While reversing engine, engineer injured thumb. Caught left hand between reverse lever and backboard of cab. Actual disability 7 days.

307 70. While operating reverse lever engineer suffered bursted blood vessel and torn ligaments in right arm. Accident probably caused from engine having been just overhauled and reverse lever worked rather hard. Probable disability, 45 days.

71. While attempting to hook up reverse lever with assistance of fireman, engineer bruised ankle and right foot. Accident caused by lever getting away from them catching engineer's foot between lever and boiler head. Probable disability, 21 days.

72. While operating reverse lever engineer sprained back. Accident occurred while placing engine in roundhouse, account reverse lever working hard. Probable disability, 30 days.

73. While backing engine out roundhouse hostler suffered internal injuries. Engine started moving forward, hostler grabbed reverse lever to swing it over, reverse lever caught him in the abdomen. Investigation developed crank pin not properly installed. Probable disability, 30 days.

74. While operating reverse lever engineer injured leg and sprained back. Engineer attempted to pull reverse lever back and instead it went forward catching left foot between lever and brake pipe. Probable disability, 31 days.

75. While operating reverse lever engineer injured right ankle. Foot slipped off bolt and reverse lever caught foot between boiler and bolt. Actual disability, 16 days.

76. While operating reverse lever engineer suffered contusion of left leg, ankle, and foot. Accident occurred while attempting to put reverse lever in backward position. Foot caught between seat box and lever. Actual disability, 8 days.

77. While operating reverse lever engineer injured right great toe. Right foot caught between reverse lever and floor of engine. Actual disability, 4 days.

78. While reversing engine, engineer strained left side. Actual disability, 8 days.

79. While operating reverse lever engineer injured left foot. Foot caught between slide and air pipe. Actual disability, 5 days.

80. While operating reverse lever engineer injured arm. Accident occurred while attempting to raise latch of reverse lever, reverse lever came back with great force pinning left arm against equalizing air pipe. Accident caused by one of large studs holding guide yoke to frame working out coming in contact with rocker arm. Probable disability, 60 days.

81. While reversing engine, engineer injured little finger of left hand. Accident caused by striking left hand against cut-out box of train control on engine. Probable disability, 21 days.

82. While operating reverse lever engineer strained back and hernia (right side). Accident result of reverse lever working hard. Actual disability, 9 days.

83. While reversing engine, engineer suffered injuries to intestines traumatic orchitis). Probable disability, 30 days.

308 84. While operating reverse lever engineer injured right hand. Accident caused by reverse lever jumping forward, catching his hand between bar and air pipe on boiler. Actual disability 10 days.

85. While reversing engine engineer strained back. Probable disability 30 days.

86. While operating reverse lever engineer suffered rupture. Accident caused by throwing reverse lever over suddenly. Probable disability 15 days.

87. While reversing engine engineer sprained hand. Accident caused by reverse lever kicking back, catching hand between lever and back of cab. Actual disability 5 days.

88. While reversing engine fireman injured foot, which became infected. Accident caused by lever striking foot. Actual disability 14 days.

89. While operating reverse lever fireman strained right side. Actual disability 9 days.

90. While reversing engine fireman sprained right hand. Actual disability 12 days.

91. While reversing engine engineer suffered internal strain. Accident occurred by engine coming out of storage and working hard. Actual disability 8 days.

92. While reversing engine engineer injured right elbow. Arm caught between reverse and bottom gauge cock. Actual disability 24 days.

93. While attempting to reverse engine engineer bruised and sprained right foot. Engineer's foot caught between quadrant and reverse lever. Actual disability 9 days.

94. While operating reverse gear engineer was thrown to cab floor, sustaining right inguinal rupture. Probable disability 60 days.

95. While reversing engine engineer injured right elbow. Struck elbow on independent brake valve or air sander valve. Probable disability 30 days.

96. While operating reverse lever engineer injured left instep. When throwing reverse lever forward foot caught between lever and head of boiler. Actual disability 21 days.

97. While operating reverse lever engineer strained back. Accident caused by reverse lever working hard account engine just out of shop. Actual disability 7 days.

98. While operating reverse lever engineer suffered injuries to left hand. Hand caught between valve and reverse lever. Probable disability 16 days.

99. While operating reverse lever hostler injured thumb on right hand. Hand caught between latch and top of lever, breaking thumb. Probable disability 3 days.

309 100. While operating reverse lever engineer sprained muscles of right forearm. Lever worked hard. Actual disability 8 days.

101. While reversing engine, engineer sprained left wrist. Arm caught between reverse lever and back end cab. Actual disability 7 days.

102. While reversing engine, engineer bruised left arm and wrist, engineer bumped elbow against back of cab. Probable disability 8 days.

103. While operating reverse lever engineer wrenched left shoulder. Accident due to dry pipe leaking causing undue pressure on reverse lever and making lever very hard to operate. Probable disability 14 days.

104. While operating reverse lever to half stroke, preparing to stop, engineer suffered severe contusion left knee. Valve strip caught lever throwing lever out of quadrant striking engineer's knee. Probable disability 6 weeks.

105. While reversing engine, engineer strained ligaments right forearm. Engine just out of shop, reverse lever hung in front corner. Actual disability 6 days.

106. While reversing engine engineer sprained arm. Caught right arm between reverse lever and side cab. Actual disability 7 days.

107. While operating reverse lever engineer sprained back. Hand slipped off lever horn causing lever to jerk and wrench back. Actual disability 9 days.

108. While reversing engine, engineer injured elbow. Accident causd by lever kicking back. Probable disability 15 days.

109. While operating reverse lever, on request of engineer, fireman strained abdomen muscle. Lever threw hard account steam in cylinder. Actual disability 7 days.

110. While operating reverse lever engineer injured left ankle. Engineer had foot against boiler head to brace himself, when foot was caught between lever and boiler. Probable disability 24 days.

111. While operating reverse lever engineer suffered cut and bruised hand. Elbow caught against back cab in such manner that palm of hand was cut and bruised. Probable disability 30 days.

112. While reversing engine, engineer bruised right ankle. Foot slipped off foot rest struck against reverse lever. Probable disability 15 days.

113. While operating reverse lever engineer suffered severe sprain of right shoulder. Accident caused by block catching in quadrant. Probable disability 30 to 60 days.

114. While reversing engine, engineer strained right upper arm and right shoulder. Actual disability 6 days.

310 115. While reversing engine, engineer sprained right foot. Accident caused by foot slipping off reverse lever shield while bracing himself. Actual disability 15 days.

116. While reversing engine right knee slightly sprained. Foot on foot brace when accident occurred. Actual disability 9 days.

117. While reversing engine, engineer suffered strain. Reverse worked hard. Engineer thought steam in cylinders. Actual disability 39 days.

118. While reversing engine, engineer suffered orchitis following strain. Engineer thought steam in cylinders making reversing difficult. Actual disability 39 days.

119. While operating reverse lever engineer sprained back. Accident occurred when engineer released latch lever jerked away. Actual disability 4 days.

120. While operating reverse lever engineer sprained muscles, left leg. Accident occurred when engineer unlatched reverse lever to put it ahead a notch, bracing with left knee against lever. Lever jumping to forward limit of quadrant. Actual disability 13 days.

121. While reversing engine, engineer injured muscles of back. Engineer stopped under pressure. Steam in cylinders making reversing hard. Actual disability 14 days.

122. While reversing engine, engineer suffered sprain, back. Accident occurred when engineer hurriedly reversed engine, not properly braced. Actual disability 15 days.

123. While reversing engine, engineer sprained back. Accident probably due to the awkward posture engineer was in when signal was given. Did not have time to straighten out. Probable disability 14 days.

124. While operating reverse lever engineer sprained right wrist. Engine handling heavy. Lever failed to latch and jerked forward. Actual disability 14 days.

125. While reversing engine, engineer suffered severe abdominal strain. Difficulty attributed to valve cap fouling valve of left steam chest. Actual disability 45 days.

126. While operating reverse lever engineer injured fingers on left hand. Hand caught between reverse lever and latch. Actual disability 6 days.

127. Engineer sprained upper arm operating reverse lever. Accident occurred when engineer attempted to throw reverse lever over. Mechanism worked harder because of low temperature. Actual disability 18 days.

128. While assisting engineer to operate reverse lever fireman blistered palm of hand. Accident due to intense vibration of reverse lever. Actual disability 12 days.

129. While operating reverse lever engineer suffered injury to left hand. Force of lever threw left hand against back of cab pinning arm in that position. Actual disability 7 days.

311 130. While reversing engine, engineer sprained neck. Reverse lever jerked engineer resulting in the accident. Actual disability 7 days.

131. While operating reverse lever engineer suffered strained back and side. Actual disability 10 days.

132. While operating reverse lever engineer mashed right foot. Accident caused by foot slipping off brace on quadrant when reverse lever slipped from hand. Actual disability 11 days.

133. While reversing engine, engineer suffered injuries to left testicle. Accident caused by reverse lever working hard. Actual disability 4 days.

134. While reversing engine, engineer sprained back. Engine just out of shop and was working stiff. Actual disability 10 days.

135. While reversing engine, engineer sprained left wrist. Left arm caught between reverse lever and cab. Actual disability 37 days.

136. While reversing engine, engineer pilot suffered injury to left hand. Accident occurred when reverse lever went back against stop block at end of quadrant. Probable disability 14 days.

137. While reversing engine, engineer suffered sprained back and side. Accident caused by foot slipping off platform. Probable disability 18 days.

138. While operating reverse lever engineer suffered broken wrist. Accident occurred by reverse lever kicking back, striking arm, when shutting off throttle. Probable disability 90 days.

139. While operating reverse lever engineer sprained back. Reverse lever worked hard. Probable disability 21 days.

140. While handling reverse lever engineer injured right arm. Reverse lever got away throwing engineer against boiler head. Probable disability 61 days.

141. While assisting engineer to operate reverse lever fireman suffered strain resulting in a hernia. Probable disability 70 days.

142. Engineer sprained right shoulder. Reverse lever jerked back and forth failing to latch. Actual disability 6 days.

143. While using reverse lever to "cushion" engine engineer suffers injuries to left foot and leg. Lever flew out of grasp and caught foot against boiler head. Probable disability 35 days.

144. While operating reverse lever engineer injured right hand. Reverse lever caught hand and bruised and cut same. Probable disability 30 days.

312 145. Engineer suffered injuries to hand. Hand caught between top of reverse lever and back wall. Probable disability 30 days.

146. Engineer suffered mashed finger. Reverse lever suddenly flew up to corner catching finger in reverse lever latch. Probable disability 30 days.

147. Fireman suffered broken bone in foot. Foot caught between boiler head and reverse lever when lever went into corner. Probable disability 30 days.

148. While assisting engineer to operate reverse lever fireman suffered contusion of palm of hand. Actual disability 17 days.

149. While operating reverse lever engineer suffered mashed toe. Accident occurred while pulling reverse lever back, lever jerked out of hand dropping down on foot. Probable disability 30 days.

150. While reversing engine, assisting engineer, hostler suffered strained back. Accident occurred while reversing engine with cylinders full of steam. Actual disability 14 days.

151. While operating reverse lever engineer sprained wrist. Accident occurred while pulling reverse lever over from forward to back. Probable disability 60 days.

152. While operating reverse lever engineer strained muscles of abdomen. Accident result of foot slipping while pulling reverse lever over. Probable disability 30 days.

153. While operating reverse lever engineer sprained left wrist. Hand caught between reverse lever and back cab. Actual disability 5 days.

154. Engineer suffered strained back. Accident occurred when changing position reverse lever. Lever went in corner pulling engineer with it. Probable disability 15 days.

155. While operating reverse lever engineer strained muscles in left side of neck. Accident result of too much clearance between face of quadrant and face of dog, causing lever to go into full back gear pulling arm. Actual disability 5 days.

156. Engineer sprained back. While attempting to reverse lever hand slipped, lever kicked, throwing engineer against corner of cab. Actual disability 12 days.

157. While operating reverse lever fireman injured right instep. Had foot in position resulting in it being jammed between quadrant and reverse lever. Actual disability 8 days.

158. While operating reverse lever engineer suffered bruises to right chest and forearm. Accident occurred when quadrant got adrift from frame causing lever to strike engineer on chest and right arm. Actual disability 19 days.

159. Engineer suffered strain to left side back and chest. Engineer had injured thumb on same date and in operating reverse lever sustained the injury to chest. Actual disability 11 days.

313 160. While operating reverse lever engineer injured left hand. Accident caused by lever going back throwing engineer in corner of cab. Probable disability 42 days.

161. While operating reverse lever engineer sprained back. Accident occurred while trying to pull over release lever. Actual disability 30 days.

162. While operating reverse lever engineer suffered bruises to left shoulder. Accident occurred when reverse lever went in forward motion throwing engineer forward. Actual disability 11 days.

163. While operating reverse lever engineer injured instep of left foot. Reverse lever slipped out of engineer's hand catching foot between reverse lever and boiler head. Actual disability 5 days.

164. Engineer suffered strained back. Injury due to the position in which engineer was standing. Actual disability 14 days.

165. While reversing engine engineer strained muscles of back. Accident result of reverse lever working hard. Actual disability 11 days.

166. While operating reverse lever engineer suffered contusion of elbow. Accident result of arm being caught between reverse lever and back cab while throwing reverse lever backward. Actual disability 7 days.

167. While reversing engine engineer dislocated second finger on left hand. Actual disability 5 days.

168. While reversing engine engineer suffered hernia. Accident occurred when foot slipped off brace pitching body forward. Actual disability 19 days.

169. While operating reverse lever engineer sprained ankle. Accident occurred when reverse slipped from engineer's hands catching leg between lever and boiler head. Probable disability 30 days.

170. While operating reverse lever engineman strained right saproiliac joint. Accident attributed to manner in which he operated lever.

171. While operating reverse lever engineman fractured bone in left hand. Accident result of reverse lever flying back striking hand. Probable disability 45 days.

172. While operating reverse lever engineman fractured a rib. Accident occurred while releasing reverse from back motion. Actual disability 16 days.

173. While handling reverse lever engineer fractured left wrist. Accident occurred when engineer attempted to drop reverse a *few notches while working under steam. Probable disability 45* days.

314 174. While operating reverse lever firemen injured right ankle and foot, and slight contusion right knee. Accident occurred while attempting to avoid collision, foot caught between reverse and seat box. Probable disability 21 days.

175. While reversing engine engineman sprained back. Actual disability 20 days.

176. Engineer suffered fracture of tibia and fibula, left leg. Reverse lever slipped out quadrant and jumped ahead striking engineer's leg. Probable disability 60 days.

177. Engineer injured left elbow. Engine stalled in snow throwing lever back and forth. Probable disability 60 days.

178. While operating reverse lever engineer sprained back. Probable disability 50 days.

179. While reversing engine engineman sprained muscles in back. Engineman twisted his body in such manner the injury resulted. Engine not in motion. Actual disability 25 days.

180. While reversing engine engineman bruised right knee. Accident occurred while engineman gave engine steam, reverse bar flew back, due to worn latch. Actual disability 10 days.

181. While reversing engine engineman sprained back. Accident occurred when engineman twisted his body in such manner that when throwing lever injury resulted. Actual disability 14 days.

182. While operating reverse lever fireman sprained back. Actual disability 4 days.

183. While operating reverse lever engineman sprained right knee. Accident occurred when engineman stood at front cab door to better operate lever, his foot slipped resulting in injury. Actual disability 8 days.

184. While operating reverse lever engineman injured left shoulder. Accident occurred while attempting to get reverse lever back. It came back suddenly, throwing elbow against brake pipe. Probable disability 60 days.

185. While operating reverse lever engineer sprained left side. Accident occurred while pulling on reverse lever. Actual disability 13 days.

186. While operating reverse lever engineman strained right testicle due to sudden jerk. Actual disability 6 days.

187. Engineer bruised ankle. Accident occurred when foot slipped, catching same between boiler head and lever. Actual disability 4 days.

188. While reversing engine hostler sprained back. Accident due to reverse lever working hard. Probable disability 15 days.

315 189. While reversing engine engineer sprained wrist. Accident due to striking arm against back of cab. Actual disability 10 days.

190. While reversing engine engineman wrenched right side. Accident occurred when his foot slipped while bracing himself against feed valve. Probable disability 30 days.

191. While attempting to reverse engine engineer sprained right side. Accident due to reverse lever kicking back account cylinders full steam. Actual disability 15 days.

192. Engineer suffers bruised face. Accident result of reverse lever getting away and striking engineer in face. Actual disability 11 days.

193. While reversing engine suffers swollen testicle. Accident result of operating reverse lever with steam in steam chest. Probable disability 14 days.

194. While attempting to reverse engine engineer bruised left elbow. Engineer's hand slipped off reverse, striking elbow against oil pan. Probable disability 14 days.

195. While operating reverse lever engineer bruised left testicle. Probable disability 30 days.

196. Engineer bruised right foot. Accident result of lever going over with great force catching foot between lever and boiler head. Actual disability 8 days.

197. While reversing engine engineer fractured left wrist. Accident result of catching forearm between reverse lever and back cab. Probable disability 8 weeks.

198. While operating reverse lever fireman suffered broken index finger. Accident occurred while assisting engineer. When engineer opened throttle finger caught in ratchet. Probable disability 25 days.

199. While operating reverse lever engineer bruised right foot. Accident result of reverse getting away catching foot. Actual disability 17 days.

200. Engineer suffered partial rupture left side. Accident result reverse lever hard to operate. Probable disability 30 days.

201. Engineer sprained knee. Accident due to reverse lever flying back, ratchet failing to properly seat. Actual disability 10 days.

202. Engineer injured left toe. Accident result of reverse lever dropping forward very quickly when latch released catching foot between reverse lever and foot rest on quadrant. Actual disability 8 days.

203. While operating reverse lever hostler injured left leg. Accident occurred when hostler tried to push lever forward with his foot. Foot caught between boiler and reverse lever. Actual disability 6 days.

316 204. Engineer injured left foot. Accident result of reverse lever slipping out of his hand, catching foot between reverse lever and boiler head, where he evidently had foot resting. Actual disability 28 days.

205. Engineer bruised left ankle. Lever struck ankle. Actual disability 20 days.

206. Engineer suffered abscess on palm of left hand. Accident occurred when bolt in reverse lever latch struck palm of hand, while letting lever down to half stroke. Probable disability 25 days.

207. Engineer strained left side. Reverse lever hard to handle. Actual disability 16 days.

208. While reversing engine engineer strained left side. Actual disability 12 days.

209. While operating reverse lever engineer bruised and lacerated left foot. Accident result of reverse lever getting away, catching foot between boiler head and reverse lever. Probable disability 25 days.

210. While assisting engineer to operate reverse lever, fireman injured right side. Accident result of foot slipping on ice and snow, causing fireman to fall. Actual disability 8 days.

211. While reversing engine engineer sprained left knee. Accident result of pulling on reverse bar, braced with left foot against boiler. Actual disability 5 days.

212. Engineer suffered water on right knee. Accident due to latch of reverse lever catching on notches in quadrant, resulting in sudden jerk. Probable disability 50 days.

213. Engineer fractured right wrist. Accident occurred while attempting to turn on lubricator, right arm caught between lever and back cab. Probable disability 30 days.

214. While reversing engine engineer injured left elbow. Engineer struck elbow on cab. Actual disability 9 days.

215. While attempting to reverse engine engineer sprained left third finger. Actual disability 9 days.

216. Engineer suffered compound fracture left leg. Accident result of engine passing over link, causing reverse lever to fly over striking engineer's leg. Probable disability 90 days.

317 Power reverse gear

A number of witnesses testified on behalf of defendants regarding accidents which have occurred on locomotive equipped with power reverse gear. The testimony of these witnesses was in certain instances supplemented by reports made by the carriers to the Commission and in other instances by reports covering investigation of the accidents by the Commission's inspectors. The facts as to these accidents are briefly set forth in the following:

1. Engineer's eye injured. Accident occurred while reversing engine, throttle flew open striking left eye. Actual disability 8 days.

2. Engineer suffered injuries to left foot resulting in amputation of four toes. Engineer failed to set independent brake before instructing fireman to move reverse lever, and foot was caught between eccentric arm and crank arm when engine moved forward. Disability permanent.

3. Engineer injured right eye. Accident result of reverse lever coming back suddenly striking eye. Actual disability 5 days.

4. Engineer injured right wrist. Accident was result of dash pot to reverse lever being empty of oil, causing unlatched reverse lever to reverse engine; lever going into backward motion. Actual disability 15 days.

5. While operating reverse lever engineer bruised right arm. Arm caught between brake valve and reverse lever. Actual disability 13 days.

6. While reversing engine engineer fractured rib. Accident caused by striking side against lever. Probable disability 10 days.

7. Engineer bruised right elbow while reversing engine due to striking right elbow on top of reverse lever. Actual disability 8 days.

8. While reversing engine engineer injured finger. Accident result of oil can falling in front of reverse lever. Finger became

jammed between reverse lever and oil can. Probable disability 4 days.

9. While reversing engine engineer injured left arm and wrist. Accident result of catching left arm between reverse lever and back of cab. Probable disability 45 days.

10. Engineer fractured right wrist. Accident result of quick and unexpected turn of reverse gear wheel. Actual disability 61 days.

318 11. Engineer strained right wrist. Accident result of reverse gear working hard. Actual disability 6 days.

12. While reversing engine engineer wrenched back. Accident resulted when engineer tried to reverse engine with shaker bar. Actual disability 29 days.

13. Fireman dislocated left thumb. Accident occurred while attempting to reverse engine, wheel to precision reverse gear hung causing him to throw entire weight on thumb. Actual disability 11 days.

14. While reversing engine, engineer fractured rib. Accident caused when engineer was struck in side by lever. Probable disability 10 days.

15. Engineer suffered sprains and bruises. Accident occurred when brakes failed to work and fireman and engineer jumped. Probable disability 30 days.

16. Engineer suffered fractured wrist. Accident caused by an unexpected turn of reverse gear wheel, which twisted right hand. Actual disability 61 days.

17. Fireman was handling engine and was crossing over from main eastbound track to westbound track to run back to terminal. Knocked latch out of the bar and in doing so it flew into the corner, went down against the boiler head, and gave fireman severe jerk which resulted in wrenched back and shoulder. Was off duty from Sept. 13 to 22nd. Engine equipped with Mellin gear, now obsolete and discarded.

18. Engineer was backing down a slight grade with four load and ten empties at about 6 miles per hour. Approaching a private crossing a truck undertook to cross making it necessary to apply the emergency brake and in addition reverse the engine. In reversing the engine the power reverse gear started kicking and caused him to lose control of the throttle. In making this emergency stop he threw out left hand to catch himself and in doing so caught two fingers between the throttle lever latch and the pin in the end of the throttle quadrant, mashing the nail off one finger and mashiig the other so that it had to have a stitch in it. Did not lose any time from work except to go to doctor and have finger dressed.

19. Stopped to take water at a stock pen on a curve. Fireman jumped down into deck and told switchman in the cab to tell the engineer he was ready to go. Fireman blew whistle and rang bell and threw reverse lever in forward motion. After he had pushed the power reverse lever discovered almost immediately that an ac-

cident had taken place. Jumped to the ground and found the engineer caught in the valve gear, his head between the radius rod and the main reservoir. Engineer died from injuries received in this accident.

20. While engineer was oiling the forward wedge and shoe in preparing the engine for work, the fireman went up on the opposite side of the engine and reversed her without any warning, catching engineer's arm between the radius rod and the guide bar. Neither employee knew that the other was on the locomotive. There was no warning given.

319 21. Going into station engine commenced to go lame, due to the valve-gear creeping. Found the power-reverse piston-packing leaking. Engineer called to fireman to throw the lever ahead a little so that he could get up to the nuts on gland to tighten them up. Stepped up on the main rod of the engine with one foot and when lever was thrown ahead the engine moved and caught his foot between the eccentric crank and the main rod. Four toes were cut off and engineer was off duty for a period of 5 months and 15 days.

22. Hostler was undertaking to back engine out of the roundhouse. Got up on engine and pulled air-reverse lever back into the corner, it did not move, then opened throttle and gave engine some steam; engine moved ahead until pilot touched the wall. This movement resulted in pinning a man between pilot and the wall. Engine had to be pulled back to release man. Employee died from injuries sustained in accident.

23. In the year 1905 or 1906 employee jumped on a runaway engine and threw the brake valve in emergency but there was no air on it. Threw the reverse lever in forward position and gave her enough steam to stop it. This prevented engine from backing onto track where a first-class passenger train was passing. If locomotive had been equipped with power-reverse gear and no air on it, it would not have been possible to have stopped it.

24. Same employee was standing on the combination lever of another locomotive, holding to the radius rod to oil top end of the link, the link bearings on the saddle pins. Asked machinist to pack the valve in the cab. While the employee was standing on the lever holding the radius rod, machinist reversed the engine to get lever out of the way, and employee was thrown four or five feet against another engine but was not hurt. This engine was equipped with a power-reverse gear.

25. Train stopped account of driving box hot. Ran engine up on a wedge preparatory to putting block between the top of the frame and the bottom of the spring saddle. The distance was too great to reach and engineer climbed up on the rod to reach between the spokes of the wheel to place the block. Someone called to the fireman to reverse the engine, which he did and caused engine to move catching the engineer's arm which was over the guide under the radius rod. Engineer's arm was badly bruised between the elbow and wrist.

26. Engineer mixed up some oil and water and poured into the air-reverse gear to soften up gasket. Stood on the frame and turned on the air and when the air was turned on the lifting arm caught foot, taking it down through a space of a quarter of an inch, crushing the whole foot and pulling out the second toe by the root. Was off duty for a period of 87 days.

27. Another accident happened to this engineer while attempting to put the engine in reverse motion. To pull the power-reverse lever from the back took both hands. It was new and very stiff and when about half-way back hand slipped down behind the latch and sprained the thumb. Was off duty for two days.

320 28. Station stop was made and the engineer placed the engine in full-forward gear ready to start and received signal to go, opened the throttle and engine would not start the train without slack. It was necessary to reverse engine. Tried to reverse engine and could not turn it back; tried it three or four times. The engineer got down on the ground and gave orders to fireman to operate the power-reverse gear as much as possible, which was done, turning the operating wheel 7 or 8 times both ways. Without any warning the wheel suddenly spun in the fireman's hand and the gear went to the extreme back motion, the handle on the operating wheel striking the fireman across the wrist and breaking two bones. Was off duty for a period of 68 days.

29. Engineer was descending grade at approximately 60 miles an hour. Got approximately one mile down the hill, had reverse gear locked when the latch jumped out due to some notches broken. Put it back and it jumped out again. Engineer then sat with hand around the latch and thumb around the rim of the wheel. This position was too tiresome so he bent a very heavy piece of wire which would loop over the top of the dog and around the rim of the wheel, wherever he desired to lock the wheel. Took hand off of the lever when the latch went out and the engine went down in the corner, full stroke, the wheel moving to the right. It appears that the spokes broke off or the rim broke off the spokes and the handle attached to that struck his knee. Did not lose any time but was under the doctor's care for two years taking treatments.

30. Engineer stopped to take water. Wanted to back up but could not reverse lever over far enough. Got down to inspect valve gear. Could not find anything on right side and went to the left side. The reverse lever came out of the quadrant and the radius rod struck engineer on the head fracturing skull. Was off duty for a period of 17 months.

31. Train stopped to take water and when ready to start engineer gave the engine steam but it would not move. Pulled the reverse lever back and got a little slack. Threw the reverse lever ahead and the engine made a lurch and broke a drawbar off the tank. Cause of the lurch was the cylinders were full of steam. Was able to put the power-reverse gear in forward motion in spite of the

fact there was steam in the cylinders. The witness does not believe that with this class of engine could have put it in forward motion with a hand lever, without opening the cylinder cocks and releasing that pressure.

32. Passenger engine ran away on account of broken eccentric rod breaking off the discharge valve of compressor, which permitted the air to escape, and left engine without any air to operate the reverse lever. Was going down grade and intended to take siding for a superior train; had no air for brakes and no air for the reverse gear. Attempted to operate the reverse gear and could not. Engineer attempted to turn steam into the reverse gear but was not successful due to operating valves being outside cab and no extension handles provided. Engineer's purpose in endeavoring to reverse the engine was to use the steam in the cylinders on the side that was not disabled and use that for breaking purposes in an endeavor to stop the engine. Was not able to stop the engine before it reached the meeting point with the other train, resulting in a head-on collision. About three quarters of a mile from meeting point
321 of two trains engineer and fireman jumped. Engineer received injury to his shoulder, the right kidney and a broken big toe, off duty for 4 months and 7 days. Fireman was off duty for one month as a result of two scalp wounds and injury to left wrist.

33. Stopped train on up-hill grade and on a curve. Got signal to go and gave engine steam but she would not move. Had to take slack. Engine had power reverse. Noticed that passing over the center the operating wheel would catch. Started to take slack, but saw that the slack was going to run away so he turned the wheel rapidly. When wheel came over center he injured or strained his shoulder. Off duty for three weeks.

34. Locomotive was standing for 15 or 20 minutes waiting for signal. Reverse gear froze up. Took some waste and oil and put some on the pipe that leads to the top of the drum. It was cold and windy; applied the torch to the waste and piece of waste hit him on the arm and raised a blister. Was off duty for 14 days.

35. Engineer suffered broken right elbow, contusions on back of neck, and cut on top of head. Fireman was killed. Engine ran away, throwing engineer and fireman off while on descending grade. Engineer heard a noise on right side of engine, and saw air pressure going back rapidly. He immediately set air and reversed engine. Engine began to slow up. Engineer jumped to the ground with a steel nut to block drivers as soon as engine came to a stop. After walking beside her for about 25 or 30 feet she moved forward with a lunge. Engineer managed to climb aboard and engineer and fireman tried to stop locomotive. There was no response from power reverse, nor could he cut in steam because of a blind gasket entirely clogging steam pipe. When they found they could not stop and the locomotive was gaining speed, they proceeded to rear end of tank from which they were thrown when engine struck curve and turned over. Engineer confined to hospital for five months.

36. Man caught in valve gear and instantly killed. Accident occurred when engineer took his position in cab and took hold of reverse lever. Engine had been cut off of train and engineer spotted engine clear of house tracks to have maintenance men and helpers do their work on her. The switch engine took charge of the train. The switch engine completed its work and the men hollered "O.K., let go." Engineer climbed to his seat, took hold of reverse lever and moved it from center to back, when a man came around, on right side, and notified engineer that another man was caught in valve gear. Engineer looked out and saw man in standing position, released lever to about center when he saw the deceased fall off backward. Rocker arm shaft caught him under jaw pushing his head against reservoir, mashing head. Engine had not started.

37. Engineer injured while oiling locomotive, being caught between bell crank and reversing yoke. Engineer pulled into Union Station from roundhouse, and, while waiting for signal to go, got down to oil around. He told the fireman to stay in cab and when he got the signal they would pull out. Fireman got signal from yardmaster, turned on bell ringer and it would not work, reached over and caught bell cord and started engine. Engineer was oiling guide cups, and was caught. Engineer disabled for about nine months.

322 38. Engineer attempted to spot locomotive at water tank on a grade and failed to get to spout. It was necessary to take slack and when he tried to reverse engine he could not get reverse gear over in backward motion. He told fireman he would get down and shut off air to power reverse gear. Engineer opened bleed cocks of air cylinder and told fireman to put reverse lever in backward motion. This, fireman was unable to do. While attempting to cut air back in, valve gear reversed catching engineer between tumbling shaft arm, air pipes, and running board, crushing muscles in arm and shoulder. Engineer off duty three weeks.

39. Engine collided with a caboose. Engineer was rounding a curve and did not see caboose. When about 40 or 50 feet from caboose, engineer got a stop signal from the ground. Engineer closed the throttle, got the straight air with one hand, and tried to reverse engine with the other hand. Started to reverse engine with power reverse, but the engine did not respond. No one injured. (Engineer claims he could have reversed engine with hand reverse.)

40. Engineer proceeding down hill, when he heard something break on left side of engine. He applied the air and engine slowed down to about 12 or 15 miles an hour. Air gauge showed air going from both main reservoir and train line. Engineer tried to reverse engine, but she would not reverse. Could not see what had happened account water and steam coming from side of engine. Told fireman to drop off to nearest telephone. Engineer rode the engine, repeatedly trying to reverse gear, but with no response. Engineer tried the whistle to brake valve, and got down on bottom step preparatory to leaving engine, the signal was against him so he let go. While

trying to turn steam into power reverse, engineer found he had twisted off the key in the extension which connects to the valve stem proper and the fountain. No injuries. (Engineer claims, in his opinion, he could have stopped engine with hand reverse.)

41. Road foreman injured while working on left side of engine attempting to release galded link block with a three-foot iron bar. There were a number of mechanics working on engine at time accident occurred. The fireman was in the cab at the reverse lever receiving orders from the road foreman. When engineer arrived to take engine he was told she had a galded link block, but would be all right to go thru. Having ten minutes to get ready. Engineer got down to oil around, and when he came to the valve gear it was being moved by the fireman who was in the cab. Engineer heard a commotion on the left side, and looking thru saw the injured man falling backwards. Injured man disabled for about thirty days.

42. While attempting to oil engine engineer suffered injuries to left hand. The reverse lever was on center, and before getting down to oil. Engineer pulled reverse over into back corner to better get at the main pins. Engine had not responded to the lever. Engineer then climbed down and was oiling when she let go catching his arm. Engineer was disabled for about three months.

323 43. While lying in the valve motion, oiling cups, a Japanese apprentice boy acting in capacity of helper was caught by reverse yoke and crushed. He died in hospital. Accident occurred in roundhouse when the machinist engaged in setting valves attempted to move engine ahead after his helper had released set screw, and said "all right, put her ahead." The gear moved about two-thirds of the way ahead and stopped. The machinist thought his helper had not released the set screw enough, got down and found the injured boy still standing on top of the ladder, and lying over the valve motion. He had been warned not to oil at that time. It was about a five- to seven-inch squeeze. (Machinist thinks he would have detected the obstruction before such serious injury occurred if he had been operating a hand reverse in the same manner.)

44. Machinist suffered broken right arm. Accident caused by power reverse flying ahead, in forward motion, causing rocker arm to strike machinist, when he turned the air on after making repairs to broken pipe leading from main reservoir to power reverse. The lever was on center when he started to turn air in.

45. Machinist helper's right hand injured. Machinist and helper were replacing cotter keys after tightening guide bolts, when suddenly, without any warning, valve gear gave a quick lunge forward catching helper's hand between reversing yoke and reach rod. Air cylinder head was off at time accident happened. (In the opinion of the witness, accident would not have happened with hand reverse. It would have given a slow pull, not a quick jerk.)

46. While lubricating engine, helper had his arm broken. Accident occurred when engineer told fireman to set independent brake and raise reverse lever, while the helper was reaching for the grease

cups on the top guide, on the inside, on left side of engine. Reverse was in forward motion, and was moved close to center at time of accident. No obstruction was noticed at the time reverse was moved to point where it was stopped. Disabled for seven weeks.

47. Hostler reversed engine, catching workman between valve rod and top guide. Injured man died. (Details not available.)

48. While oiling high-pressure oil cups, engineer had his hand mashed. Accident occurred when fireman, acting on instructions from yardmaster, moved reverse lever in back motion to get engine uncoupled from train. Car inspector told fireman to throw reverse in forward motion and that he had caught engineer. This released engineer's hand. Injured man was off duty two years and four months. (Witness thought injury may not have been so severe if a hand reverse had been used.)

49. Fireman was injured when engineer moved reverse lever from back motion to forward. Fireman was oiling on left side of engine at time of accident. He suffered bruises to chest. No obstruction was felt when engineer pulled reverse lever over. (Witness does not believe accident would have happened with hand reverse.)

324 50. While trying to find air leak around brake cylinder firemen was caught between radius bar and air drum and held there. Accident occurred when engineer reversed engine and backed down track. Engineer was not aware he had caught fireman until notified by a negro porter. Injured man had his back and muscles of his sides injured. Off duty twelve days.

51. While in the process of oiling left front driving box, fireman reversed engine catching engineer's arm between radius bar and link frame, severing the arm. Fireman did not know he had caught engineer's arm until notified. Permanent disability.

52. When about four miles out of station something broke about the reversing gear. Upon reaching station engineer found piston rod of reverse cylinder broke. While pressing on radius bar with shaker bar, piston shot out of cylinder, and hit shaker bar straining ligaments in engineer's back. Disabled twenty-nine days.

53. While on running board oiling engine engineer had his arm broken. Accident happened when engineer told fireman to move engine ahead. Engineer's arm was caught between lever and running board.

54. While renewing packing in cylinder head machinist had hand injured. Accident occurred when last nut had been removed off forward cylinder head. She let go driving hand against cock rigging. Before removing nuts machinist tried reverse lever to see if any more air was in cylinder. Disabled eight weeks.

55. While working on left side of engine engineer's left hand was caught. Accident occurred when machinist who was making repairs to valves, moved the reverse lever to get the steam into back end of cylinder. Probable disability two months.

57. While assembling train and to get over the hump, engineer had to use the reverse lever. Accident occurred when reverse lever

kicked, catching engineer's arm against window, causing cuts and bruises. Disabled 6 weeks.

58. While reversing engine engineer suffered fractured right wrist. Accident occurred when air reverse stuck, then suddenly released, reverse wheel striking engineer's wrist. Disability about 6 weeks.

59. While attempting to remove tender brake beam, which had fallen down, engineer suffered crushed right arm, making amputation necessary, internal injuries, and left side partially paralyzed. Before the accident reverse was left in center position. After the accident reverse was found in forward position. Accident caused by engine moving forward, probably the result of reverse lever latch and quadrant teeth being worn, and air reverse cylinder slide valve leaking. Permanent disability.

60. While backing up with 2 cars in front of engine making about 30 miles an hour, and when within about 2,000 feet of switch, the air line between pump and main reservoir broke. Engineer attempted to set the air brakes, and found he did not have any air. He immediately notified fireman, and tried to reverse engine, but being air-operated the reverse failed to move, at the same time
325 giving engine more steam which increased the momentum. When they saw a collision was unavoidable the crew prepared to jump. Engineer's head bruised, face cut and bruised, back and left side bruised, probable disability six days; fireman, compound fracture of left thigh, left leg broken between hip and knee, and body bruises, probable disability twelve months, possible permanently; brakeman, both ankles sprained, probable disability five days.

61. Fireman had three bones in right foot broken. Engineer unable to back up to release coupling. Valve to air reverse closed. In order to open valve fireman stood on counterbalance, when the valve was opened and before fireman could get his foot out of the way, air reverse shot forward pinching foot between counterbalance and reverse rod. Probable disability thirty days.

62. Machinist wrenched left knee. Machinist was using a bar over radius rod to force new packing leathers in reverse cylinder. Piston of power reverse moved causing machinist to slip to the ground injuring knee. Engine was dead at time of accident.

63. While operating reverse lever, engineer was bruised, and suffered sore shoulder and arm. Accident occurred on a grade while hauling train of coal, with a helper on rear end. Engine began to slow down. Engineer attempted to adjust reverse lever and instead of going down she started kicking, and kicked engineer back against cab. Engineer does not remember how long he was off duty.

64. While oiling air pump fireman's hand was on set screw which holds tumbling shaft. He asked engineer to reverse engine so that he could oil valve, when tumbling shaft caught his fingers. Off duty forty-six days.

65. In attempting to move engine to roundhouse fireman opened throttle, but engine wouldn't move. He opened it a little more and

still she wouldn't move. Fireman put reverse lever on center and when he did so engine went forward with cylinders full of steam and full boiler pressure. He immediately put automatic brake valve in emergency, but before he could stop, engine went thru roundhouse wall, doing about $500 damage.

66. While working on left side of engine machinist was caught between valve stem guide and radius rod and killed. Machinist and machinist helper decided it was necessary to back up to spot engine over pit to inspect valves. Engine had just been equipped with power reverse and it was necessary to start pump to get air enough to move her. When he had about seventy pounds of air machinist helper moved lever back, stopped, put on brakes, put the reverse lever on center, shut off pump, and came down on the left side. He found machinist with his head caught between valve stem guide and radius rod.

67. While oiling engine engineer had his hand injured. Engineer had taken engine from roundhouse, spotted engine at the water tank, and while taking water proceeded to oil around. Engineer put his hand between reverse yoke and valve frame to pull himself up to oil top part of reverse yoke, and the air reverse went from center to forward corner, catching hand and cutting off three fingers. The gear released his hand by going into back corner. Disabled for five weeks.

326 68. Engine had received a general overhauling and had been placed on track just outside the shop, to be tested under steam. Engine started to move, and the traveling fireman, who was in the cab, tried to reverse her. The air pump having just been started prior to engine moving, there was not enough air to operate reverse gear or brakes. The engine continued down the track, killing one man and injuring two others. The locomotive moved due to leaking throttle valve.

69. While oiling engine engineer had his arm broken. Engineer had his arm under the radius rod oiling the wedges, when the reverse lever and links moved ahead catching arm. Engineer did not know what caused reverse gear to move. Off duty about two years.

While these accidents are now attributed by defendants to the fact that the locomotives were equipped with power reverse gear, it is significant that in no case was the power reverse gear removed after the accident and hand reverse substituted. The locomotives involved, if in use, are still equipped with power reverse gear.

The foregoing analysis does not cover all of the accidents which have occurred and in which reverse gear was involved, but only such cases as are referred to in the reports and testimony of record in this proceeding. The record shows that during the five-year period from 1925 to 1929, inclusive, there were 1,116 casualties due to reverse gear. The proportion of such casualties occurring on locomotives equipped with hand reverse gear is illustrated by the fact that of 233 cases occurring in 1929 and 1930 a total of 217 occurred on locomotives equipped with hand reverse gear and 16 on locomo-

tives equipped with power reverse gear. During the latter period there were about the same number of locomotives in service with power reverse gear as with hand reverse gear. It is our understanding that the record contains the facts as to practically all accidents which have occurred on locomotives equipped with power reverse gear and in which the reverse gear was involved. On the other hand the record and the above analysis cover in detail only a small proportion of the total accidents which have occurred on locomotives due to hand reverse gear.

327 Many of the witnesses testifying on behalf of defendants were asked to express an opinion as to the relative merits of power and hand reverse gear from the viewpoint of safety. There is little or no occasion to consider expert opinions upon this question because there is available the actual experience gained over a period of many years in the operation of thousands of locomotives having such equipment thereon.

The accidents which have occurred on locomotives equipped with hand reverse gear are attributable to several conditions. On many locomotives the hand lever is located behind the boiler head and at the side of the engineer's seat box. The clearance between the lever and the back board of the cab is frequently very small. In fact, on some locomotives the lever when in extreme backward position extends beyond the back board of the cab, the back board being cut out to permit the lever to pass. On other locomotives the clearance between the lever and the seat box as well as between the lever and the boiler head and appurtenances thereon is very small. Many accidents have occurred due to engineers and others being caught between the hand reverse lever and the other parts referred to, due to the close clearance provided. On most locomotives a stop block or pin is provided near the ends of the quadrant for the purpose of limiting the travel of the reverse lever so that it will not come in contact with the cab or the boiler and the appurtenances located thereon. If the stop block is missing or, for any reason, fails to function there is in most cases nothing to prevent the lever from coming in contact with the boiler or the cab, and numerous persons have been injured because this condition existed.

It will be appreciated that the space in which the engineer must work while operating the locomotive and while in his usual

328 and proper position in the cab, is quite limited. This is especially true on the larger and modern locomotives. On such locomotives he has little opportunity or chance of avoiding being struck by the hand lever if, for any reason, it suddenly moves. The fact that the hand reverse lever does suddenly move without warning to the engineer and from various causes, is clearly established by evidence and the fact that many injuries have resulted from such movements of the hand lever is also clearly established by the evidence. We do not deem it necessary for the purposes of this report to deal

separately with various conditions which arise in actual operation and cause the hand lever in the cab to move suddenly and with force sufficient to cause injury if the person operating the locomotive is not able to get in the clear. Many of the circumstances under which this situation arises are set forth in the brief summary of the accidents included herein.

Of the 216 accidents recorded as due to hand reverse gears all occurred to employees while handling the reverse gear, while of the 69 accidents attributed to power reverse gears 22 accidents occurred to men operating reverse gears while the others occurred to persons on, or around, or in the path of the moving locomotive.

Frequent reference is made in the record to the extent to which the injuries attributable to the hand reverse lever could be avoided if the engineer would be more careful as to where he placed his arms and legs while operating a locomotive equipped with hand reverse gear. It will be appreciated, however, that in actual operation and with the varied and frequent movements which the engineer is required to make in order to properly perform his duties, he cannot reasonably be expected to constantly keep clear of the
329 reverse gear in the cab. In theory this might be possible, but in actual practice it cannot reasonably be expected. The engineer or other person operating the locomotive is as a matter of actual fact constantly subjected to whatever hazard exists in operating the hand reverse gear, and under many circumstances he has no way of effectively guarding against injury.

The operation of the reverse gear is affected by numerous elements. Chief among these which are reported as causes for accidents listed elsewhere in this report are the failures due to breakage of parts of the valves or the valve gear, lack of lubrication, the presence on parts of the reverse gear of frost, ice, or snow, and the presence of steam in the cylinders which may be due either to leaking throttle valve or to leaking dry pipe, or to imperative cylinder cocks or cylinder cock operating rigging.

In actual operation the reverse gear must be moved frequently, the frequency varying with different classes of service. In switching service it is not uncommon for the reverse gear to be moved from 30 to 60 times an hour. In road service the movements are less frequent, but even in that service the reverse gear is moved several times each hour the locomotive is in use. The engineer is liable to be injured not only while making such adjustments, but also on other occasions if the reverse gear moves suddenly and without being touched.

Defendant carriers urge that the equipment of locomotives with power reverse gear does not eliminate accidents and that the power reverse gear has not been applied with the thought of promoting safety. As explained by the carriers, the application of power reverse gear has been due to the increasing size of locomotives and the

limited clearance between the boiler and the side of the cab rendering it impracticable to apply hand reverse gear. The carriers urge that in several respects the use of power reverse gear is more hazardous than hand reverse gear.

330 In practically all, if not all, installations the power reverse gear is moved by compressed air. Frequently while locomotives are around terminals the air compressors are not in operation and no air pressure is available with which to operate the reverse gear. When there is no pressure in the operating mechanism of the power reverse gear the weight of the valve gear causes the parts thereof to settle or drop so that if steam is admitted to the cylinders with the valve gear in this position the locomotive may move notwithstanding that the operating lever in the cab is at the center of the quadrant. It will be understood that ordinarily when the operating lever in the cab is at the center of the quadrant the valve gear is likewise in center position and that steam would not be admitted to the cylinders so as to move the locomotive even though the steam throttle was opened. If the air compressors are started after the valve gear has settled, as referred to above, the valve gear will, as the air pressure increases, gradually assume a position corresponding to the position of the operating lever in the cab. Instances have occurred where the engineer in oiling around was caught due to this unexpected movement of valve gear parts. Other instances have occurred where the operating lever in the cab was placed in a position that would ordinarily cause the locomotive to move in the desired direction, but due to the absence of necessary air pressure the valve gear would not move to a corresponding position, thus causing the locomotive to move in the wrong direction. Fatal injuries have resulted from this cause.

As previously explained, the power reverse gear ordinarily depends upon air pressure for its operation. Instances have occurred where by reason of a broken air pipe or from other similar causes air pressure on the reverse gear was lost. Under such circum-

331 stances the power reverse gear is inoperative unless steam can be admitted into the operating cylinder. Steam connections are provided on many locomotives equipped with power reverse gear so as to avoid the possibility of the reverse gear becoming inoperative when for any reason air pressure is not available. Such steam connections are seldom used, however, and are frequently not properly maintained so that they may be operated and serve their purpose when occasion arises. In one instance a collision resulted from the fact that no air pressure was available on the locomotive, thus rendering both the air brakes and reverse gear inoperative, and in this case a blind gasket was found in the steam line to the power reverse gear which, of course, made it impossible for the engineer to admit steam into the reverse gear cylinder. In another

similar case the stem of the valve in the steam line to the power reverse gear was twisted off in effort to open the valve so that in this case the steam connection could not be employed to serve the purpose for which it was applied.

In isolated instances due to one cause or another locomotives have unexpectedly moved when no air pressure was available with which to operate the air brakes. Under such circumstances it is possible in some cases to stop the locomotive by reversing the engine and admitting steam to the cylinders. The carriers urge that this is a safety feature which may be employed with hand reverse gear but which is absent with power reverse gear because air pressure is necessary to operate the power reverse gear just as it is necessary to operate the air brakes.

Instances have occurred where serious and fatal injuries have resulted from employees being caught between some of the valve gear parts and other parts of the locomotive when the power reverse gear was moved. The carriers urge that with manually operated reverse gear the presence of an obstruction, such as the arm or the
332 head of a man could be detected by the resistance offered to movement of the hand lever or wheel, whereas with the power reverse gear this would not be the case.

Complainants urge that there is no liability of injury to the engineer in the cab due to action of the reverse gear on locomotives equipped with power reverse gear. They also contend that the power reverse gear promotes safety by making it possible for the engineer to constantly observe signals. In this connection it is said that with hand reverse gear it is necessary that the engineer bring his head and body inside of the cab in order to move the reverse gear, whereas with power reverse gear it is practicable for him to reverse the engine without losing sight of signals and men who may be working around the locomotive.

Defendants estimate that the average cost of equipping a locomotive with power reverse gear would be approximately $400.00. The power reverse gear is more expensive than hand reverse gear so far as maintenance is concerned. Complainants urge that this expense would be offset by increased efficiency obtained from the locomotive due to faster operation being possible with power reverse gear than with hand reverse gear. Defendants urge on the contrary that due to what is generally termed "creeping" of the power reverse gear, it is less efficient than hand reverse gear. The term "creeping" refers to movement of the reverse mechanism as well as the valve gear without the operating lever in the cab having been adjusted which causes an undesired change in the point at which the admission of steam into the cylinders is cut off. The thought is that the creeping makes it impossible to use steam in the most economical manner and that this results in unnecessary fuel consumption.

While defendants urge that the carriers generally are in such financial condition that they should not be required to make the expenditure necessary to apply power reverse gears, we think the question of financial ability to apply the requested equipment cannot, as a matter of law, properly have any bearing upon the decision of the Commission in this case. Any other view leads to the conclusion that the provisions of existing law, and evidence, mean one thing at one time and something else at another time. There has probably never been a time when some carriers subject to this law were not in as difficult financial condition as carriers generally are at present. In Baltimore & O. R. Co. v. Groeger, 266 U.S. 521, the Supreme Court held that:

"Under this act, it is the absolute duty of carriers to keep locomotive boilers in safe condition to operate, so that they may be used without unnecessary peril to employees."

And in Lehigh Valley R. Co. v. Beltz, 10 Fed. (2d) 74, certiorari denied, 270 U.S. 641, the court held that—

"this act as amended imposes on carriers of interstate commerce an absolute duty to keep their locomotives free from defects and absolutely safe to operate; 'absolute duty' meaning one not subject to any limitation or condition, and unqualified by any consideration whatever."

In United States v. Southern Ry. Co., 1 Fed. (2d) 487, it was held that a strike of the carriers' employees did not justify the failure to comply with the provisions of this act and the rules established in accordance therewith.

As a practical matter we are, in the main, looking to the future in the consideration of this case. The recommendation made herein with respect to locomotives now owned by the carriers is that those having more than a specified weight on driving wheels be equipped with power reverse gear when they are shopped for
334 class 3, or heavier, repairs. A large proportion of these locomotives are for one reason or another now out of service. The last annual report of the Commission shows that there were at that time 9,840 locomotives stored in serviceable condition and 6,442 others out of service, undergoing or awaiting repairs. A large percentage of these locomotives are equipped with hand reverse gear. Whatever expense results from these applications will be distributed among a large number of carriers and spread over a period of approximately 4 years. A large number of the locomotives equipped with hand reverse gear are now set aside awaiting disposition and will never be again used. Many of the locomotives in service with hand reverse gear will be dismantled before they are again given class 3, or heavier, repairs. The point is that adoption of the recommendation made herein does not mean that the carriers will be re-

quired to immediately make large expenditures in order to comply therewith.

The occurrences in actual operation of locomotives, so far as they relate to safety, are so clearly shown by the summaries of accidents included herein that it is unnecessary to consider that question further.

The question before the Commission in this case is whether the use of any or all steam locomotives equipped with hand reverse gear causes unnecessary peril to life and limb, and if so whether the application of power reverse gear would improve the situation. The answer is to be drawn principally from the accidents described in the record and briefed herein.

Clearly the carriers of this country would not have equipped over 28,000 locomotives with power reverse gear, and would not contemplate so equipping practically all new locomotives, if such gears did not contribute to efficiency of locomotive operation or if power
335 reverse gear is less safe than hand reverse gear. The question of creeping resolves itself largely into a question of proper maintenance. If the power reverse gears are properly maintained we think creeping to any material extent will be largely eliminated. As to the ability to detect an obstruction in the valve gear, such as a man's head or arm, by the resistance offered to movement of the hand reverse gear, in time to avoid injury we do not think such a theory is sound. The matter of power reverse gears becoming inoperative while on the road due to loss of air pressure could be taken care of by properly applied and maintained steam connections. As to locomotives moving unexpectedly, and crashing through roundhouse walls or into turntable pits, it is common knowledge among railroad men that such movements are not confined to locomotives equipped with power reverse gear but have also occurred on locomotives equipped with hand operated reverse gear.

Several of the accidents and much of the trouble set forth in the record as occurring on locomotives equipped with power reverse gear occurred on locomotives equipped with what are now obsolete installations, and the difficulties encountered on such locomotives cannot be reasonably expected with modern installations.

Counsel upon brief refer to the language of the Commission in Public Utilities Commission of Ohio *v.* Pennsylvania R. Co., 151 I.C.C. 448, at page 464, with reference to the relative importance of serious or fatal injuries and minor injuries, and urge that the principle there announced is applicable in the present case. We are wholly in accord with what was there said, and if the application of power reverse gear will have the result of causing serious and fatal injuries in order to avoid what defendants term minor injuries the use of power reverse gear should be prohibited. But we cannot believe that the carriers would contemplate the contin-
336–337 ued use of over 28,000 steam locomotives with power reverse gear, and contemplate the application of power reverse gear

on new locomotives, if those in charge of the construction and operation of locomotives actually and sincerely shared the belief expressed by counsel in this case. Witnesses for the carriers, who were asked the question, were firm in their opinion that the Commission should not require power reverse gear to be removed from present locomotives and hand-operated gears used in lieu thereof.

While we believe defendants are unsound in several of their contentions, we likewise are of the opinion that complainants are unsound in their reasoning that all steam locomotives should in the interest of safety be equipped with power reverse gear. The latter contention ignores differences in size of locomotives and parts thereof, differences in speed, cab clearances, and in other conditions encountered in actual operation.

To draw a line of demarcation which will provide the degree of safety contemplated by the law and yet not cause unnecessary expense on the part of the carriers is not easy. Our best judgment is that power reverse gear should be required on all steam locomotives used in road service having a weight in working order of 150,000 pounds or more on driving wheels, and on all steam locomotives used in yard service having a weight in working order of 130,000 pounds or more on driving wheels. Power reverse gear should be applied to all such new locomotives before they are placed in service, and to locomotives in service as they receive class 3, or heavier, repairs as defined by the United States Railroad Administration,[1] and all such locomotives should be so equipped by not later than January 1, 1936.

338 The adoption of this recommendation would make it unnecessary to apply power reverse gear on approximately 14,000 locomotives now in use.

The Commission should enter an appropriate order amending the present rules in accordance with these recommendations.

339 *Plaintiff's exhibit no. 5*

[File endorsement omitted.]

I, George B. McGinty, Secretary of the Interstate Commerce Commission, do hereby certify that the attached is true copy of petition for reargument, filed February 11, 1933, in docket no. 24050, A. Johnston, grand chief engineer of Brotherhood of Locomotive Engineers et al. v. Atlantic Coast Line Railroad Company et al., the original of which is now on file and of record in the office of this Commission.

In witness whereof I have hereunto set my hand and affixed the seal of said Commission this 15th day of June A.D. 1933.

[SEAL] GEORGE B. MCGINTY,
*Secretary of the Interstate Commerce Commission.*

[1] Class 3 repairs was defined by the United States Railroad Administration as follows: Flues all new or reset (superheater flues may be excepted); necessary repairs to firebox and boiler; tires turned or new; general repairs to machinery and tender.

340–341 Before the Interstate Commerce Commission

Docket No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF Locomotive Engineers, and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, *complainants*

VS.

ATLANTIC COAST LINE R.R. CO., ET AL., *respondents*

PETITION FOR REARGUMENT

Now come the respondents, whose names are listed in the appendix to the original answer in this proceeding and certain additional respondents stated in the record at the beginning of the hearings (R.15), and, through the American Railway Association, respectfully petition the Commission to grant a reargument before the whole Commission therein, and in support of said petition respectfully show:

I. The report errs in deciding that the Commission has
342 jurisdiction in this proceeding in the manner and form here instituted, for the following reasons:

"(1) In the several respects set forth in paragraphs II, III, and IV in the supplemental answer filed by these respondents May 11, 1931;

"(2) There is no authority conferred upon the Commission by the Boiler Inspection Act, as amended, or by any other law, to entertain the complaint in this case, or to proceed thereunder in any manner;

"(3) The only authority granted to the Commission under the Boiler Inspection Act, as amended, is to approve, modify, or disapprove such rules as may be submitted to it under the provisions of said act;

"(4) The said Boiler Inspection Act, as amended, grants to the Commission no authority to make or initiate the making of new rules;

"(5) No power is granted to the Commission under the Boiler Inspection Act, as amended, to initiate modification of existing rules;

"(6) There is no authority granted to the Commission under the said Boiler Inspection Act, as amended, nor under any other law, to conduct a hearing, as was done in this case, for the purpose of investigating and determining whether or not additional rules or modification of old rules under the act should be formulated, nor is any authority vested in the Commission to proceed initially with the consideration or formulation thereof at any such hearing or in any other manner."

II. The report errs in attaching significance to the fact that,
343 as to certain accidents on or about locomotives equipped with power reverse gears, in no case was the power reverse gear removed after the accident and hand reverse gear substituted.

The uncontroverted evidence in the whole record is that the choice between hand reverse gear and power reverse gear installations on particular locomotives has not been controlled by considerations of safety, nor on a basis of choice between safety devices. Such choice has been controlled by considerations of locomotive design, labor saving, difficulty of manipulating the very large locomotives, cab arrangement, and desires of the men. All the evidence shows, likewise, no instance of removal of any hand reverse gear because of an accident resulting from that gear. The report gave significance to the failure to remove any power reverse gear after an accident, gave no significance to the corresponding failure to remove any hand reverse gear after an accident, hence gave an arbitrary significance and weight to evidence which had no weight on a comparison between the two devices as to safety.

III. The report errs in finding that the proportion of casualties occurring on locomotives equipped with hand reverse gears during the five-year period from 1925 to 1929, inclusive, due to reverse gears, is illustrated by the fact that of 232 cases occurring in 1929 and 1930, a total of 216 occurred on locomotives equipped with hand reverse gears and 16 on locomotives equipped with power reverse gears.

The 232 cases above referred to were reported to the bureau
344 of statistics of the Commission and classified by that bureau under the heading "Reverse levers, operating." This, however, constitutes no accurate indication of the comparative frequency of accidents with the two classes of gears because the record shows that accidents with power reverse gears are of a more varied character, and from such accidents shown in this proceeding it is quite apparent that many of them are such as would not properly or logically be filed under the bureau of statistics' classification above mentioned. To justify a conclusion as to the relative frequency of accidents with the two types of gears, it would be necessary to examine the individual accident reports of the carriers year by year and ascertain the number of accidents attributable to power reverse gears, since no statistics regarding them are so classified as to be practically available save under this one classification.

IV. The report errs in discarding by inference the testimony of respondents' witnesses who testified as to the relative merits of power and hand reverse gears from the viewpoint of safety because, as stated in the report, there is ample evidence of the actual experience gained over a period of many years in the operation of thousands of locomotives having such equipment thereon.

The witnesses presented by the respondents were not only enginemen and machinists but mechanical officials of long experience in both operation and supervision of the operation of locomotives. Their opinion is entitled to substantial weight unless controverted by actual experience. The record, however, substantiates the
345 views expressed by them. It shows that accidents from power reverse gears are more varied in character and usually are

more serious in result than those from hand reverse gears. Injuries due to accidents from power reverse gears were received not only by engineers and firemen but by other employees working on or around locomotives, whereas injuries from hand reverse gears are largely confined to enginemen. The record discloses eight deaths to employees working on or around locomotives equipped with power reverse gears, due to the improper operation of such gears, as contrasted with one death in the case of a locomotive equipped with a hand reverse gear. In the latter case, the accident which resulted in the fatality was due to the inexperience and excitability of a hostler, who failed to move the operating lever. The result would have been the same in this case if the locomotive had been equipped with a power reverse gear. The air pressure was insufficient to operate the brakes, so the power reverse gear would have been likewise inoperative. If, however, the hostler had been able to operate the hand reverse lever, the accident could have been avoided thereby.

V. The report errs in its discussion of clearances in the cab by emphasizing that such clearances are frequently very small and ignoring the testimony of many witnesses on behalf of both sides in this proceeding, indicating that on the vast majority of engines now in service, equipped with hand reverse gears, these clearances are sufficient and there is ample room in the cab for the engi-
346 neer to safely and conveniently engage in his duties in operating the locomotive. The record further shows that there was testimony given by a number of witnesses that where clearances have been found to be insufficient these conditions have been, or may readily be, remedied by changing the location of air pipes or brake valves, installing stop blocks or pins and cutting out or rearranging back boards.

VI. The report errs in rejecting the contention of the respondents that the ability to stop a locomotive with a hand reverse gear when no air pressure is available to operate the air brakes, is a safety feature that is not present on a locomotive equipped with a power reverse gear, since there is no air pressure to operate the latter gear.

It would seem self-evident that if there are circumstances under which a locomotive equipped with a hand reverse gear can be stopped and, under identical circumstances, a locomotive equipped with another type of gear cannot be stopped, that a locomotive equipped with a hand reverse gear is safer in that respect.

VII. The report errs in holding that the theory is not sound that with a manually operated reverse gear the presence of an obstruction—such as the arm or the head of a man—could be detected by the resistance offered to the movement of the hand reverse, in time to avoid injury, whereas with the power reverse gear this could not be done.

It is respectfully submitted that this contention of the respondents is not a theory but is a fact demonstrated by the uncontroverted evidence in this proceeding. A number of witnesses testified
347 that, based upon their experience, they were of the opinion

that an obstruction, such as a man's arm or head, could not be felt when operating a power reverse gear, but could be felt when operating a hand reverse gear. Other witnesses testified to this effect from actual experience. The only attempt to controvert such evidence was in the case of a fireman who had a bone in his little finger broken when it was caught between the reversing arm and the back of the gear frame. The engineer testified he felt no obstruction. It is obvious that the engineer could not have felt an obstruction until the parts came in contact with the little finger. Because of the small diameter of that finger, it is clear that the opportunity for the engineer to feel an obstruction was negligible and, if felt, the bone would have been broken by the time the obstruction was felt.

VIII. The report errs in stating the contention of the complainants that there is no liability of injury to the engineer in the cab due to action of the reverse gear, on locomotives equipped with power reverse without pointing out that the record discloses that such injuries actually occur in the cab of locomotives equipped with power reverse gears.

The report gives controlling significance to an asserted absence of injuries to engineers and firemen in the cab caused by power reverse gears, when the record shows there were such injuries, and gives insufficient significance to the numerous and serious injuries to such employees outside of the cab and to other classes of employees,
348 caused by power reverse gears, and to the dangers to the public resulting therefrom. In dealing with a device on the theory that it is a safety device, the law is as much interested in the safety of all other classes of employees, passengers and members of the public, as in the safety of engineers and firemen.

IX. The report errs in stating, with apparent approval, the contention of the complainants that power reverse gears promote safety by making it possible for the engineer constantly to observe signals, without pointing out that this contention is controverted by 40 engineers and various mechanical officials and, in addition, that the record does not disclose a single accident resulting from a failure to keep a lookout while operating a hand reverse gear.

X. The report errs in concluding that the carriers of this country would not have equipped approximately 29,000 locomotives with power reverse gears if such gears did not contribute to efficiency of operation or were less safe than hand reverse gears.

The undisputed evidence shows that these locomotives were so equipped for reasons other than safety. The controlling motive for thus equipping such locomotives was that of design. The later types of locomotives are larger and the space in the cab is more restricted because of the increase in size of the fire box. Older types of locomotives were originally equipped with hand reverse gears and, as to some of them, such hand reverse gears were replaced with power reverse gears, these changes being made at the request of the engineers.

349 The suggestion that the efficiency in locomotive operation is promoted by the installation of power reverse gears will be discussed in the next assignment of error.

XI. The report impliedly admits that the fault in power reverse gears called "creeping"—namely, the movement of the reverse mechanism as well as the valve gear, without the operating lever in the cab having been adjusted—results in unnecessary fuel consumption; but the report errs in finding that if power reverse gears are properly maintained, "creeping" to any material extent would be eliminated.

The record discloses that a considerable amount of "creeping" has been experienced on many railroads; that it has occurred with all makes and types of power reverse gears; that it has occurred repeatedly and continued in spite of intensive efforts on the part of railroad mechanical forces to maintain power reverse gears at a high standard; and that repairs frequently eliminated the "creeping" temporarily, but that it often recurred after a short interval of time.

The record conclusively shows not only that "creeping" increases fuel consumption and affects efficiency of operation, but also that such erratic action is a characteristic of power reverse gears, involving a real potentiality of danger to life and limb of employees and passengers, which does not exist at all in connection with hand reverse gears.

XII. The report errs in finding that the matter of power reverse gears becoming inoperative on the road due to loss of air pressure can be taken care of by properly applied and maintained steam
350 connections, in that it did not find, what the uncontradicted record shows, that a considerable amount of corrosion normally builds up on these valves. Of necessity these are moved or manipulated infrequently, which makes it difficult and sometimes impossible to operate them so as to cut in the auxiliary steam supply quickly in an emergency.

XIII. The report errs in stating that locomotives moving unexpectedly and crashing through roundhouse walls or into turntable pits are not confined to locomotives equipped with power reverse gears but have also occurred on locomotives equipped with hand reverse gears, without stating that the record shows that substantially more of such accidents occur with locomotives equipped with power reverse gears than with locomotives equipped with hand reverse gears.

XIV. The record bears out the statement in the report that several of the accidents set forth in the record occurred on locomotives equipped with what are now obsolete power reverse gear installations, but it is respectfully submitted that the report errs when it states that much of the trouble set forth in the record occurred on locomotives equipped with such obsolete installations.

The record is replete with evidence of trouble of varied character on locomotives equipped with the modern types of power reverse

gears, and even with the most highly perfected types. Consequently, it is not reasonable to expect that the difficulties encountered will disappear with modern installations.

351 XV. The report errs in holding that the conclusions reached in the decision in this case in no way conflicts with the language of the Commission in Public Utilities Commission v. Pennsylvania R. Co., 151 I.C.C. 448, 464.

In the cited case, commonly known as the Fire Box Door case, the Commission found that injuries caused by the mechanically operated fire-box door were minor as compared to the injuries coused by the hand-operated fire-box door, and said:

"This presents the question whether these minor injuries shall be permitted to preclude the use of an appliance which experience shows has and will prevent injuries much more serious and not infrequently death. The answer is found in the words of one of the defendants' principal witnesses; that is, it does 'not matter how many minor injuries you have, you could not have enough of them to counterbalance one death.'"

In the light of this language of the Commission and of the evidence in this proceeding, which shows that accidents from the operation of power reverse gears have resulted in many serious injuries and eight deaths, compared with relatively few serious injuries and no deaths properly attributable to the operation of hand reverse gears, it is respectfully submitted that the language in the Fire Box Door case is quite pertinent and is controlling, and that the report herein is in conflict with the decision in that case.

XVI. The record errs in its conclusion that the financial burden necessary to comply with its order is justified to afford relief in the future from the conditions complained of.

352 The record strikingly discloses the substantial and progressive decline in net railroad operating income and in traffic during the calendar year 1930 and for the better part of 1931. The Commission is informed of the continuation of the decline in net operating income and traffic since that time. It is a matter of common knowledge that the carriers have found it necessary to institute the most rigid economies and to avoid any expenditure which is not imperatively required. As a consequence, it is reasonable to expect that class 3 and heavier repairs have been postponed when not immediately necessary. These repairs cannot be deferred indefinitely. No one can predict with accuracy how long the present economic conditions will continue. To require, therefore, an outlay of substantial sums for purposes that the record conclusively shows are not imperatively needed, it is submitted would place an undue burden upon the carriers and, to that extent, affect their ability to furnish efficient and adequate transportation.

XVII. The report errs in not finding the following facts as justified by the record in this proceeding:

"(1) That engineers under ordinary conditions are able to handle the hand reverse gears without trouble or difficulty and without exerting any undue or unusual amount of strength;

"(2) That engineers operating hand reverse gears are not adversely affected physically because of the operation of such gears;

"(3) That the operation of hand reverse gears does not interfere in any way with the ability of an engineer to keep a lookout for signals;

353 "(4) That accidents caused by the operation of hand reverse gears resulted in injuries usually of a minor character and were relatively few in number. That injuries so sustained by complainants' witnesses, who testified as to their length of service, averaged one injury in approximately 25 years of service; and that the injuries so sustained by respondents' witnesses, who testified as to such accidents, were few in number and most of these witnesses had sustained no injuries due to the operation of hand reverse gears during their entire length of service;

"(5) That the erratic performance of manually operated reverse gears is relatively rare;

"(6) That the cost of maintenance of power reverse gears as compared to the maintenance of hand reverse gears is from 13 to 14 times as great;

"(7) That neither the hand reverse gear nor the power reverse gear is a safety device;

"(8) That the use of locomotives equipped with hand reverse gears does not cause unnecessary peril to life or limb within the meaning of the Boiler Inspection Act, as amended;

"(9) That the record in this proceeding does not justify an order requiring the installation of power reverse gears on locomotives of the respondents."

Wherefore, the respondents pray that a reargument be granted in the above-entitled case; that the order be stayed until reargument before and decision by the whole Commission thereon; and that the Commission enter such further order or orders in the premises as to it may seem reasonable and just.

354 Respondents listed in the appendix in the original answer, and certain additional respondents stated at the beginning of the hearings (R. 15).

By AMERICAN RAILWAY ASSOCIATION,
R. H. AISHTON,
*President.*

SIDNEY S. ALDERMAN,
H. Z. MAXWELL,
NYE F. MOREHOUSE,
ALFRED P. THOM, JR.
*Counsel for Said Respondents.*

ALFRED P. THOM,
*Of Counsel.*

WASHINGTON, D.C.,
*February 11, 1933.*

355 *Plaintiff's exhibit no. 6*

[File endorsement omitted.]

I, George B. McGinty, secretary of the Interstate Commerce Commission, do hereby certify that the attached is true copy of supplemental petition for reargument, filed February 28, 1933, in docket no. 24050, A. Johnston, grand chief engineer of Brotherhood of Locomotive Engineers, et al. v. Atlantic Coast Line Railroad Company et al., the original of which is now on file and of record in the office of this Commission.

In witness whereof I have hereunto set my hand and affixed the seal of said Commission this 15th day of June A.D. 1933.

[SEAL] GEORGE B. MCGINTY,
*Secretary of the Interstate Commerce Commission.*

356–357 Before the Interstate Commerce Commission

Docket no. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, complainants

*vs.*

ATLANTIC COAST LINE R.R. CO. ET AL., RESPONDENTS

SUPPLEMENTAL PETITION FOR REARGUMENT

Now come the respondents, whose names are listed in the appendix to the original answer in this proceeding, and certain additional respondents stated in the record at the beginning of the hearings (R. 15), and, through the American Railway Association, respectfully show the following in elaboration of the assignment of error, no. 12, in the original petition for reargument:

358 The report errs in the requirement that steam connections shall be applied and maintained on all locomotives irrespective of the type or design of power reverse gear with which a locomotive is equipped. The record contains uncontradicted evidence that there is in use a type of power reverse gear, namely, the Franklin Precision, which may be operated either by hand with a screw, or by air.

This requirement was predicated upon the thought that if air pressure failed, the power reverse gear could still be operated by cutting in the auxiliary steam supply; manifestly, if the Franklin Precision reverse gear, in the event the air pressure fails, can be operated by hand, there is no necessity for the installation of a steam connection on locomotives equipped with such gears. Such a requirement as to locomotives so equipped is unreasonable and arbitrary.

Wherefore, the respondents pray that a reargument be granted in the above entitled case; that the order be stayed until reargument before and decision by the whole Commission thereon; and that the Commission enter such further order or orders in the premises as to it may seem reasonable and just.

359 Respondent's listed in the appendix in the original answer and certain additional respondents stated at the beginning of the hearings (R. 15).

By AMERICAN RAILWAY ASSOCIATION,
R. H. AISHTON, *President.*
SIDNEY S. ALDERMAN,
H. Z. MAXWELL,
NYE F. MOREHOUSE,
ALFRED P. THOM, Jr.,
*Counsel for Said Respondents.*

ALFRED P. THOM,
*Of Counsel.*
WASHINGTON, D.C., *February 28, 1933.*

*Plaintiff's exhibit no. 7*

[File endorsement omitted.]

I, George B. McGinty, Secretary of the Interstate Commerce Commission, do hereby certify that the attached is true copy of petition for extension of effective date of order, filed June 1, 1933, in docket no. 24050, A. Johnston, grand chief engineer of Brotherhood of Locomotive Engineers, et al. v. Atlantic Coast Line Railroad Company et al., the original of which is now on file and of record in the office of this Commission.

In witness whereof I have hereunto set my hand and affixed the seal of said Commission this 15th day of June, A.D. 1933.

[SEAL.] GEORGE B. MCGINTY,
*Secretary of the Interstate Commerce Commission.*

360 Interstate Commerce Commission

No. 24050

A. JOHNSTON, GRAND CHIEF ENGINEER OF BROTHERHOOD OF LOCOMOTIVE ENGINEERS, et al.

*v.*

ATLANTIC COAST LINE RAILROAD COMPANY, ET AL.

PETITION FOR EXTENSION OF EFFECTIVE DATE OF ORDER

The defendants in the above-entitled proceeding, 443 in number represented by the American Railway Association and 252 in number represented by the American Short Line Railroad Association, appearing by and through said Associations and their respective

counsel, hereby present to the Commission their request for a modification of the Commission's order as heretofore amended herein, and in this behalf show to the Commission:

1. That the said order of the Commission, as amended, requires that steam locomotives above certain specified weights on the drivers shall have power reverse gears and steam connections applied the first time that the said locomotives are shopped for class 3 or heavier repairs after July 1, 1933, and that all locomotives already
361 equipped with power reverse gears must have steam connections applied to them prior to July 1, 1933. Compliance with the latter part of the said order contained in subdivision (c) thereof would affect approximately 29,000 locomotives already equipped with power reverse gears and would make necessary the installation of steam connections prior to July 1, 1933, regardless of whether or not the said locomotives were shopped prior to that date. This last requirement in itself would entail a large expenditure of money, running as high as $100,000 each railroad in the cases of several of the largest railroads. Approximately 18,000 locomotives are affected by the requirement of the order with respect to the installation of power reverse gears, at an estimated aggregate expense of $7,500,000.

2. The railroads feeling aggrieved at the said order, through representative petitioners, on May 31, 1933, filed their petition to annul and set aside the said order in the United States District Court for the Northern District of Ohio, Eastern Division, and the said court has fixed June 19, 1933, as the time for the hearing of application for temporary stay and interlocutory injunction. The said petition raises serious, substantial, and very important questions as to the jurisdiction of the Commission to enter the said order and as to the legality and validity of the said order, and it is submitted that it is of importance to the Commission, the railroads, and the public that the issues raised in that litigation be authoritatively disposed of by the courts. In view of the fact that compliance with the Commission's order with reference to the equipment of locomotives with power reverse gears and an effort to comply with the Commis-
362 sion's order with reference to the installation of steam connections will entail a tremendous expenditure of money, it is respectfully submitted, particularly during the present economic difficulty of the railroads, that there should be an extension of the effective date of the said order pending the disposition of the litigation referred to. This request appears altogether consistent with the views expressed by the Commission in its report herein, wherein the Commission recognizes the financial condition of the railroads, but observes that in the main the Commission's order looks to the future rather than to the present. The railroads will prosecute the said litigation in good faith and as expeditiously as is feasible, and respectfully ask that in the meantime the Commission postpone the effective date of its order so that in the event that the railroads prevail in the said litigation there will not in the meantime have

been expended large sums of money which will not be recoverable. It is, of course, well known to the Commission that in the existing economic crisis the railroads are in no position to make any expenditures that are not imperatively necessary. Any such expenditures would result in the diversion of funds from purposes essential to the public welfare to purposes which without detriment may certainly for the time being be postponed.

Under the circumstances, the railroads have deemed it a more orderly course of procedure to present this petition to the Commission for extension and relief pending the financial determination of the litigation, thereby avoiding the necessity for court action with respect to temporary stay and the delay incident thereto, and enabling a more expeditious and orderly determination of the issue.

Wherefore, defendants request that the effective date of the said order be extended pending the final determination by the courts of the pending litigation.

Respondents named in appendices to original answers.

By AMERICAN RAILWAY ASSOCIATION,
(Signed) R. V. FLETCHER, *General Counsel.*

By THE AMERICAN SHORT LINE RAILROAD ASSOCIATION,
(Signed) CLARENCE A. MILLER, *Assistant General Counsel.*
WASHINGTON, D.C., *June 1, 1933.*

363 In United States District Court for the Northern District of Ohio, Eastern Division

(File endorsement omitted.)

No. 4681 In Equity

THE BALTIMORE AND OHIO RAILROAD COMPANY ET AL.

*vs.*

UNITED STATES OF AMERICA

Before Hickenlooper, Circuit Judge, West and Killits, District Judges.

*Opinion*

Filed Nov. 24, 1933

PER CURIAM:

This is a representative action brought by a number of the leading railroads of the United States, and in the interest of substantially all of the steam operated carriers of the country, to enjoin the enforcement by the Interstate Commerce Commission of amendments supplementary to its rule 157, ordered by the Commission in January of this year, after a very extensive hearing, and on the joint com-

plaint of the chief engineer of the Brotherhood of Locomotive Engineers, and the president of the Brotherhood of Locomotive Firemen and Enginemen. 190 Interstate Commerce Commission Reports, 351.

The complaint was instituted under the provisions of the Boiler Inspection Act to raise the question of the comparative safety between manually and power operated reverse gears on locomotives, and to seek an order compelling the equipment of steam locomotives with power reverse gear, and the substitution on locomotives in use of such gear for the manually operated apparatus thereon employed.

A very extensive fact record, embracing the testimony of hundreds of witnesses familiar with facts underlying the question in contest, was produced. The order sought to be enjoined entails an ultimate expense upon the carriers of between seven and eight million dollars in the changing of gears on more than twenty thousand locomotives now in use.

Further recitation of the facts is unnecessary here. Special recital of those particularly involved will be had. Nor does it
364 seem necessary to attempt an elaborate analysis of the very large record and a full discussion of the many reasons advanced by the parties respecting the action of the Commission leading to the order complained of.

We consider that the report, 190 I.C.C., 351, adequately meets whatever requirement may exist for a statement of conclusions of fact, in view of section 14 (1), 49 U.S.C.A.; Lehigh Valley R. Co. v. Clark, 207 Fed., 717, 721.

At the threshold of inquiry stands the earnestly contested question whether the Interstate Commerce Commission, hereinafter referred to as the Commission, was empowered to entertain, as in this instance, a complaint of employees' organizations seeking an amendment of such rules as are required to be adopted under the Boiler Inspection Act. It is conceded that if jurisdiction in the Commission existed to act upon such a complaint, it is to be found only in that act, secs. 22, et seq., 45 U.S.C.A.

Were the question one of first impression, and we had nothing before us but the language of the act itself, this court would have difficulty in finding legislative support for the jurisdiction exercised by the Commission in this instance, except through a very broad application of the rule of liberal construction. Yet, to refuse such construction to the act, would lead to a conclusion tending to a large degree of frustration of the office of this legislation to effect the purpose of the act as reflected in its title, to which we, of course, may refer in doubtful cases, which reads:

"An act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their locomotives with safe and suitable boilers and appurtenances thereto."

However, from the beginning the Commission has exercised the authority now questioned, and in twelve orders prior to July
365 1925, amended, eighteen of its rules to require improvements in, or installations of, special safety devices on steam locomotives. Then followed the decision of the United States Supreme Court in Napier v. Atlantic Coast Line, et al., 272 U.S. 605, in which the question was whether the Boiler Inspection Act had so occupied the field of regulating locomotive equipment so as to preclude State legislation. It is urged on behalf of the plaintiffs here that the opinion in the Napier case, so far as it touches upon the question of jurisdiction in the Commission to entertain such a complaint, is obiter. There is color of justification for this claim. But we are not content to so lightly regard its office. The question before the Supreme Court involved a comprehensive consideration of the force of the Boiler Inspection Act, and the authority of the Commission thereunder; so much so that the language of the opinion cannot be regarded by us as merely collateral to the issue there, but rather impellingly applicable as an interpretation of the whole statute as operatable legislation. Advised by it, we find necessity to uphold the jurisdiction of the Commission in this specific instance.

In the pleadings, and in the presentation of this case, the fact situation before the Commission is comprehensively presented and argued. It is unnecessary to cite extensive authority for the proposition that we have a very narrow opportunity to consider the evidence. The privilege and duty of the Commission to function speedily and effectively as an administrative body must be sustained.

The general rule controlling us is that we should not weigh evidence, nor consider the wisdom of the Commission's action if its determination finds substantial support in the fact record, Chicago R. I. & P. Ry. v. U.S., 274 U.S., 29, 33; we cannot inquire into the soundness of the reasoning by which its conclusions are reached, nor question the wisdom of regulations prescribed by it. 271 U.S., 268, 271; 215 U.S., 452, 471; 265 U.S., 533, 542. But we may regard the fact situation to determine, if it is claimed, whether the
366 Commission has acted arbitrarily or inconsiderately in some particular. B. & O. R. R. Co. v. U.S., 264 U.S., 258; Interstate Commerce Commission v. L. & N. R. Co., 227 U.S., 88, 90, 91; U.S. v. Abilene & So. R. Co., 265 U.S., 274; A. T. & S. F. Ry. Co. v. U.S., 284 U.S., 248.

The challenge to scrutinize the fact record within the limitations just alluded to is earnestly made by the petitioners in this case. It cannot be disputed but that the Commission hearing an issue of the character raised by the complainant, and leading to the order under consideration, sat under the limitations of a judicial body, and became in the process of fact finding virtually a jury bound to use the applicable criteria controlling jurors in the weighing of the probative force of matters of evidence. That the Commission is an administrative tribunal "appointed by law and informed by experience"

does not differentiate it in this respect from a jury at law. Therefore, here are raised the queries whether the order is supported by substantial evidence, and whether in arriving at its conclusions of fact the Commission acted arbitrarily respecting the comparative potentialites of important facts establshed, and/or by ignoring "the indisputable character of the evidence." I.C.C. v. Louisville & Nashville R. R., supra. To refuse to consider pertinent evidence introduced is arbitrary action. Chicago Junction Case, 264 U.S., 258, 267. The distinction between refusal to heed, and palpable neglect to give, substantial evidence the weight it manifestly carries, in casting up the affirmative and negative matters in the testmony, is immaterial—either is arbitrary.

Opportunity is at hand, presented by the Commission's report, to examine into petitioners' challenge that the Commission was arbitrary in the consideration of the case made, and that it arrived at its conclusions through disregarding or ignoring substantial
367 testimony. Petitioners, in their exceptions to the draft report of the examiner, in their motion for findings of fact and in their petition for reargument, were thorough in directing the attention of the Commission to the circumstances which they considered to support these charges. We comment on some thereof, solely because the report affords sufficient illumination, and, in so doing, understand that we have no concern with the reasoning of the Commission upon the facts accepted by it, and no right to attempt setting up a judgment as to the issue.

It is urged that the Commission refused to apply its own standard respecting the determination of the weight of conflicting testimony that the substance thereof, rather than the volume, should be regarded.

In the Automatic Fire Door case, 151 I.C.C., 448, the Commission said on this point:

"This presents the question whether these minor injuries shall be permitted to preclude the use of an appliance which experience shows has and will prevent injuries much more serious and not infrequently death. The answer is found in the words of one of the defendants' principal witnesses; that is, it does 'not matter how many minor injuries you have, you could not have enough of them to counterbalance one death.'"

This applicable and sensible principle was clearly disregarded in the instant case. Here the Commission very plainly based its fact finding by tallying, or numbering, the injuries attributable to hand-operated gears on the one hand, and power gears on the other; in effect giving the same consideration to a slight or temporary injury as to a serious—even a permanent—injury, when comparing the merits as to the safety of the rival devices. It appears that weight was given to the numbers comparatively, rather than to quality. Oral testimony on the subject of casualties was received from about one hundred witnesses, approximately evenly divided between the contending appliances. As we count them, forty-eight persons were

injured on engines equipped with hand gear, and forty-seven when the gears were power actuated.

368 Among lever hand-geared locomotives there were two casualties producing permanent injury. The rest were much less serious, very many of them comparatively trivial, although there were several hernias and also cases of broken bones. It is surprising how many casualties in cases of hand-equipped locomotives flowed from carelessness of position of the operator, carelessness of operation, neglect of proper general maintenance, worn quadrants, and faulty inspection after shopping. At least eighteen instances are in evidence in which such indiscretions or neglect were the underlying factor. One engineer on another engine was killed and his fireman injured painfully as the result of a collision where a locomotive equipped with lever hand gearing "got away" from an excitable and somewhat inexperienced engineer, who was relieved from duty therefor. It is quite evident that carelessness is more provocative of untoward results in cases of manual gearing, due to the placing and character of the motivating apparatus, than when the reversing is by the wheel or where power, air or steam, is employed.

Going to engines equipped with power-actuated gears, the evidence disclosed nine deaths; several permanent injuries; a fractured skull, involving seventeen months' lay-off, and an award of $10,000.00; an amputated arm; and eight other cases where the injuries exceeded in severity any of those shown to have occurred on engines equipped with hand apparatus. These eight casualties cost the carriers affected approximately $35,000.00 in compensation and expenses. The contrast in respect to severity of casualties between the two classifications is exceedingly striking.

Complainants were permitted to supplement their oral testimony by the introduction of 232 copies of "Reverse levers, operating" accident reports (form T). Of these, 190 were in locomotives equipped with hand gears, other than hand-screw gears, and not already covered by oral testimony, 11 were in connection with power reverse

369 gears, 3 with hand-screw gears. Giving this secondary and documentary testimony the same acceptance enjoyed by oral testimony, although respondents were deprived of the right of cross-examination, the count of physical injuries shown favors the complainants in the approximate ratio of over three to one. But the great preponderance of substantial injuries coming from the use of power gearing continues unaffected by this class of testimony. The 190 injuries shown on the form T reports, where lever hand gears were used, were minor in character, involving in no instance any permanent disability. In none of them was the injured party off more than sixty days, more than two-thirds causing but from four to fifteen days' lay-off. It is urged by the carriers that these form T reports do not exhaust the number of casualties attributable to power-actuated gears, because so many thereof are reported under another classification.

On pages 359, 360, 190 I.C.C., of the Commission's report, it is said:

"The carriers urge that with manually operated reverse gear the presence of an obstruction, such as the arm or the head of a man, could be detected by the resistance offered to movement of the hand level or wheel, whereas with the power reverse gear this would not be detected. * * * As to the ability to detect an obstruction in the valve gear, such as a man's head or arm, by the resistance offered to movement of the hand reverse gear, in time to avoid injury, we do not think such a theory is sound."

There is something more than theory in this claim. If it is a fact there is potency in it on the question of comparative safety. Two witnesses operating levers testify to the feeling, one being a case where an engineer's head was the obstruction, and much opinion from men experienced with both kinds of gears. It is also supported by reason—the presence of an obstruction is directly notified to the operator of a lever, whereas the operating wheel simply starts insensate machinery into operation.

Upon the question raised that the Commission has ignored its own standard respecting the comparative seriousness or injuries incurred in the two contesting classifications, its report contains
370 this language, with which we cannot concur:

"Counsel upon brief refer to our language in Public Utilities Commission of Ohio v. Pennsylvania R. Co., 151 I.C.C. 448, 464, with reference to the relative importance of serious or fatal injuries. The conclusions here reached in no way conflict with the principle there announced."

Continuing from the language above quoted, and as part of its comment on petitioner's criticism this is said:

"Aside from the evidence of record we cannot believe that the carriers would contemplate the continued use of over 29,000 steam locomotives with power reverse gear, and contemplate the application of power reverse gear on new locomotives, if those in charge of the construction and operation of locomotives actually and sincerely believed that power reverse gear is less safe or less efficient than hand-operated reverse gear."

This observation convicts the Commission of a clear disregard of undisputed testimony, and of the use, to support its conclusions, of such testimony in violation of its true import. It is uncontradicted that for twenty years or more the carriers have been preferring power operated reversing appliances over hand gear, in more powerful engines, not because the former are found intrinsically safer, but for the reason that the enlarged boiler capacity, sought for in later engines, restricts very materially cab space, wherefore power gears are now installed for that the cab stationed operation appliance in such gears takes but a fraction of space therein of that necessary for the levers and locking devices of the manual apparatus, and further, in the same direction, because in the restricted cab space less movement of the operator is required to actuate power reverse than in the

case of the earlier gears. To use the preference of the carriers, for power reverse gears, as evidencing insincerity on their part in taking issue with the complainants on the question of comparative safety is inexcusable, under circumstances clearly shown.

The same reason, which is seen to be the motivation for preferring power appliances in later practice has caused the installation in fifteen hundred and fifty locomotives of a hand device, which
371 is operated in the cab by a wheel measurably comparable in form and situation to that used in power devices. The evidence suggests that this sort of manual operation meets every objection offered by the complainants, as illustrated by their evidence touching the causes of almost every accident attributable to manually operated gears. This is shown by the discussion by the Commission of the occasion of injuries resulting from the use of hand (lever operated) gears, found on page 356 of its report, as follows:

"The accidents which have occurred on locomotives equipped with hand reverse gear are attributable to several conditions. On many locomotives the hand lever is located behind the boiler head and at the side of the engineer's seat box. The clearance between the lever and the back board of the cab is frequently very small. In fact, on some locomotives the lever when in extreme backward position extends beyond the back board of the cab, which is cut out to permit the lever to pass. On other locomotives the clearance between the lever and the seat box, as well as between the lever and the boiler head and appurtenances thereon, is very small. Many accidents have occurred, due to engineers and others being caught between the hand reverse lever and the other parts referred to, due to the small clearance. On most locomotives a stop block or pin is provided near the ends of the quadrant for the purpose of limiting the travel of the reverse lever, so that it will not come in contact with the cab or the boiler and the appurtenances located thereon. If the stop block is missing or, for any reason, fails to function, there is in most cases nothing to prevent the lever from coming in contact with the boiler or the cab, and numerous persons have been injured because this condition existed."

It appears from the testimony that during the years '30 and '31 but two accidents were reported, from these 1,550 locomotives, attributable to the use of this modified hand gear. It is plain that the Commission totally disregarded this evidence, and failed to perceive its import as affecting the reasonableness of its classification of power gears on the one hand, and hand-operated gears on the other hand, whatever manual apparatus was employed to actuate them. Notwithstanding this testimonial to the comparative safety of the hand-screw reverse gear, showing that, at the worst, it is approximately as safe as power reversing gears, and that such apparatus should have been classified with wheel actuated power gears on the issue of comparative safety, the Commission arbitrarily rejected that device, and required by its order, wherever weights on the wheels met the order's

conditions, that even this improved device increasing safety to the operator should be removed, and power gears installed.

372 That the Commission proceeded on the theory that, on the issue before it, it was concerned only with the safety of engineers and firemen is apparent. This is shown in this quotation from the report (page 355, 190 I.C.C.):

"The record shows that during the 5-year period from 1925 to 1929, inclusive, there were 1,116 casualties due to reverse gear. The proportion of such casualties occurring on locomotives equipped with hand reverse gear is illustrated by the fact that of 232 cases occurring in 1929 and 1930 * a total of 216 occurred on locomotives equipped with hand reverse gear and 16 on locomotives equipped with power reverse gear. During the latter period there were about the same number of locomotives in service with power reverse gear as with hand reverse gear."

Such treatment of the fact situation is not justified. Consideration of the question of safety should not be limited to dangers to cab stationed employees only. The object of the Boiler Inspection Act, as expressed in its title, already quoted, is to promote the safety of employees generally and travellers. This conclusion is forced, also, by sensible construction. The evidence shows that while the safety of enginemen may be promoted by the use of power gears, eccentricities of operation, outside of the cab, and trickiness of operation due to circumstances arising from the intracacies of the machinery and temporary insufficiencies of the power sought to be used, circumstances undetectable at times, are causative of the most severe and most numerous injuries to employees engaged in the outside care of the locomotive, or about it on other duties, and the same conditions confront, at times, the general public and passengers with the gravest dangers. This is shown by impressive and uncontradicted evidence. The quotation just exhibited advises that the Commission, in arriving at the ultimate question, disregarded, without justification, this

273 extremely important factor of consideration, which properly should have weighed substantially against the conclusion which the Commission reached.

One tendency peculiar to power reverse gears, shown clearly by a large amount of testimony, and met with no contradiction, is that of "creeping"—an unexpected movement of the engine, forward or in reverse, caused by temporary conditions affecting the apparatus which show their presence only in their untoward results.

The term "creeping" is defined in the report (page 360, 190 I.C.C.) as a "movement of the reversing mechanism as well as the valve gear without the operating lever in the cab having been adjusted, which causes an undesired change in the point at which the admission of steam into the cylinders is cut off." It is shown by much evidence that the tendency to so move unexpectedly is confined

* This refers to exhibit 13, form T report (Injuries, "Reverse levers, operating"), already discussed, which covered only 190 cases, as actually shown by the report, not already in by oral testimony, and dealing with lever operating devices.

to power geared locomotives. How lightly the Commission considered the importance of this constituent of the fact situation is shown by this quotation from the same page of the report: "The fault termed 'creeping' causes no accidents and resolves itself largely into a question of proper maintenance." The statement that these movements cause no accidents is inexplicable in the face of its showing that at least one death was so brought about, as well as several severe injuries—in one instance involving total disability. One other death appears, but less clearly, to have been so caused. Several other instances are shown where such movement was very destructive of property, where, fortunately, no human was in the path of the locomotive's unexpected movement.

The Commission's thought that "if the power reverse gears are properly maintained * * * 'creeping' in any material extent will be eliminated", and that the question is one of "proper maintenance", is applicable, with the same force, to conditions, exhibited as casual, producing casualties occurring in usage of hand
374 gears, for instance, the cases where a lever latch jumped the quadrant notch in which it was seated, the movement invited because the quadrant teeth had become worn into a rounded condition. The testimony is ample and without contradiction that hand gears, because more simple in construction, are more quickly responsive to the operator's appliance, in cases of emergency.

The Commission states (report, 190 I.C.C., 353) that 30,038 locomotives, equipped with hand gear, were under inspection at the time of hearing. It also refers to Exhibit 13 (Form T Reports) which total 232 casualties alleged to be due to reverse gear operations for the years 1929 and 1930. An analysis of these reports is given the Court, the accuracy of which is not disputed. This shows at least 24 which are not attributable to actual operating lever worked gears. The result is that in two years operating casualties calling for Form T reports among 30,038 hand gear equipped locomotives were 208 in number—an average of one casualty, trivial or serious, in two years, to 144 locomotives, or, in one year, one to 288 locomotives.

The evidence also exhibits, very clearly, a fact which we can consider without trenching on the doctrine that we must leave preponderance, as the Commission found it, namely, that the testimony so approaches an equilibrium on the vital question that the placing of the preponderance is a matter of considerable deliberation.

Power reverse gears have been known and in use for more than twenty years. Hand actuated gearing devices are very much older. As rivals for distinction as involving less "unnecessary peril to life or limb" they were operated side by side, for nearly a quarter of a century, before it was thought worth while to make the debatable question subject of formal investigation, and then, the record discloses, the very employees whose safety was directly involved, are

found so divided in two camps that a very formidable minority disagree with the Commission's conclusions.

375 In a hazardous occupation, one casualty, indifferently serious or trivial, occurring in a year in a group of 288 locomotives, does not suggest a very seriously existent "peril to life or limb." Also, the question of comparative peril, between the use of one class of devices and that of another, each involving hazards, is not observable to be itself very imperative of solution, when reaching a decision requires grave consideration of a large volume of evidence to be weighed in sensitive scales that a preponderance be ascertainable.

The foregoing discussion would, perhaps, be inept if it were not for a record situation to which it becomes pertinent.

In their answer, dated January 29, 1931, before the Commission the petitioner said:

"As is well known to this honorable Commission, the carriers are in no position at this time to be put to the necessity of increased expenses or to make expenditures which are not essential. Part of this is due to the general, world-wide depression in business, which, it is hoped, will be temporary, but a large part of the depleted condition of their revenues is due to the effects of competition by other agencies of transportation, largely if not entirely unregulated, and at least a substantial part of this competition is likely to be permanent. At a time when it is necessary to make a survey of the entire railroad situation and to adopt every means that is wise and suitable to enable them to continue to furnish adequate transportation to the public, it is believed that it will be unfortunate and against the public interest to create for them necessities for expenditures which can be avoided compatibly with adequate and economical service to the public and proper protection to the employees, as is the case here. To grant the prayer of the petition in this case would involve the expenditure of a very large amount of money. The expenditure of any amounts that are in any case available may be, and are now being, made in other directions which will promote the public and employee welfare and safety in a very much larger degree than that proposed in the complaint.

The employees constitute an integral and essential part of the industry conducted by these respondents, and it is to their interest, as well as to the interest of the security holders of these respondents and of the general public, that expenditures not pressingly necessary should not be required of the carriers at this juncture."

The position then taken has been consistently maintained—last presented for the Commission's consideration in the carriers' petition for rehearing in February last which was denied. That

376 it was supported, in January 1931, by cogent facts so notorious as to be well within judicial notice, A., T. & S. R. Ry. v. U.S., 284 U.S. 248, is very clear, and it was directly a matter of proof of the most serious kind. That, in January 1933, when the order was made, the financial situation of the carriers had become

much more difficult, and that the effective competition of truck, bus, automobile, and aeroplane had greatly intensified were also facts within judicial knowledge—indeed matters of which the Commission, more or less officially, was cognizant.

The Commission's response to this part of carrier's defense is: "Nor are we unmindful of the financial condition of the carriers, which was strongly urged as a reason for denial of the relief here sought. But we can not belive the present financial condition will be permanent and we are convinced that action should now be initiated to afford relief in the future from the conditions complained of" (190 I.C.C. 362).

The very serious effect of new competition, plainly increasingly embarrassing throughout 1931–32, and which should be considered as a presently effective, and steadily growing obstruction to recovery of the carriers from their financial troubles, even if the prevailing general depressed conditions should improve, apparently the Commission ignored altogether, although it should have occurred to that body that, to meet, in any substantial degree, that competition, abandonment of a large amount of equipment, especially traction, would be necessary, followed by unusually large expenditures for effective substitution of new types.

The plain deduction from the record is that the issue of comparative safety before the Commission in 1931, was not exigent, having lasted then for years. In fact it was diminishing in importance, because of obsolescence of locomotives equipped with hand gears, and, further because of the sure prospect of important changes in traction equipment. But the question of financing the change demanded by complainants was pressing and highly important.
377 In this, as the defendants answered, the employees themselves had a large interest. For rehabilitation, replacements, and proper maintenance, not only for the effective continuance of the carriers' public duties, but obligatory to preserve a reasonable degree of safety to employees generally, was at least as pressing as duty upon the carriers as to secure the effect at which the order was directed. Under these circumstances we feel that the Commission was inconsiderate to the extent of inexcusable neglect in passing over, so lightly, a plea of financial distress to which it should have given the most serious attention; City of Lowell v. R. R., 238 Mass., 328.

Epitomizing what has already been said—The Commission was bound to give legal effect to facts established in evidence, Oregon R. & N. Co. v. Fairchild, 224 U.S., 510, 525; its order should be set aside if disregard by it is shown of substantial and uncontradicted evidence having a bearing upon the issue, S. W. Tel. Co. v. Public Service Commission, 262 U.S., 276, 287; and to refuse to consider pertinent and substantial evidence is considered arbitrary action, sufficient to set aside its order, Chicago Junction Case, supra.

The doctrine that this Court cannot question the conclusion at which the Commission arrives if that is sustained by substantial testimony follows the presumption that the triers of fact have fairly

considered all of the pertinent testimony offered by the parties and, that, in so doing, have applied the same criteria in determining the probative quality and force of evidence from each side. When this presumption is negatived in the record the rule must fail—otherwise it would be a shield for arbitrary or inconsiderate action.

378 We need not prolong this discussion by considering other specifications of the defendants. The Commission's attitude, as reflected by its report in the instances we have considered, calls for the application here of the principles above stated. We find that attitude to have been so arbitrary and so regardless of its duty to fairly considered all of the pertinent and substantial facts established before it that we should restrain the enforcement of the order complained of. So directed.

(Signed) SMITH HICKENLOOPER.
(Signed) S. H. WEST.
(Signed) JOHN M. KILLITS.

NOVEMBER 23, 1933.

380 In United States District Court for the Northern District of Ohio, Eastern Division

[File endorsement omitted.]

In Equity No. 4681

THE BALTIMORE AND OHIO RAILROAD COMPANY ET AL., PETITIONERS

*vs.*

UNITED STATES OF AMERICA, INTERSTATE COMMERCE COMMISSSION, et al., defendants

*Findings of fact and conclusions of law*

Filed Jan. 30, 1934

The above-entitled suit having come on to be heard, and the court having heard arguments of counsel, and its per curiam opinion having been filed, since which the death of Judge Hickenlooper has occurred, the majority of the court now makes and files its findings of fact and conclusions of law as follows:

FINDINGS OF FACT

1. Each of petitioners is a railroad corporation and common carrier for hire and brings this suit in a representative capacity under provisions of the Urgent Deficiency Appropriations Act of October 22, 1913.

The object thereof is to annul and enjoin enforcement of an order of the Interstate Commerce Commission made in a proceeding

brought before it on complaint of the chief engineer of the Brotherhood of Locomotive Engineers and the president of the Brotherhood of Locomotive Firemen and Enginemen, both residents of Cleveland, Ohio.

Said complaint, Commission dócket no. 24050, alleges that all locomotives equipped with manually operated reverse gears are being operated by the railroads in violation of the so-called Boiler Inspection Act, because such devices are unsafe and unsuitable and
381 locomotives so equipped cannot be operated without unnecessary peril to life or limb. In said proceeding an order of the Commission was sought requiring the railroads to substitute for manually operated reverse gears on such locomotives, reverse gears operated by power, alleged to be safe and suitable.

2. On various hearings upon said complaint and the answers thereto, over 330 witnesses whose testimony covered over 6,400 pages of record, were heard, and more than 100 exhibits were received, in 55 days devoted to taking testimony. The proposed report prepared by the examiner who heard the case recommended that power reverse gears be required on all steam locomotives used in road service having a weight in working order of 150,000 pounds or more on driving wheels, and on all steam locomotives in yard service having a like weight, of 130,000 pounds or more. The Commission entered its report and made its order on January 5, 1933 (190 I.C.C. 351).

3. Said order will require substitution of power operated for hand operated gears on over 17,000 locomotives, at an ultimate expense upon the carriers of approximately seven million dollars in making such changes and applying certain emergency steam connections in connection therewith and to locomotives already equipped with power reverse gears.

4. In its consideration of the case the Commission failed and refused to give consideration or legal effect to important material facts established before it by evidence substantially uncontradicted, and ignored and disregarded the indisputable character of such evidence; and reached conclusions contrary thereto and unsupported by any substantial evidence; all as more particularly shown below:

(a) The use of power reverse gears on locomotives has not eliminated all accidents caused either in connection with such
382–383 use or by failure or the gear properly to function. Such accidents have included the same types as occur where manually operated gears were used, viz, strains, bruises, cuts, broken bones, etc., received in the engine cab in connection with handling the reverse mechanism, and injuries to enginemen and others outside the cab when oiling or otherwise attending to their engines. Accidents of the former type are more numerous on hand reverse locomotives, and of the latter type more numerous accidents have occurred, inflicting much more serious injuries, including several deaths from operation of power reverse gears.

(b) Hand gears being simpler in constructions, respond more readily in cases of emergency; and in such situations when air pres-

sure is not available to operate gears, may be quickly and effectively employed to control movement of the locomotive and avert accidents; whereas in the same situation power reverse gears depend upon air pressure, so that an engine equipped therewith cannot be so controlled except where there is time to cut in an emergency steam connection to operate the gear.

(c) The report at p. 360 states it to be a matter of common knowledge that hand reverse locomotives sometimes move unexpectedly into roundhouse walls and turntable pits. The evidence shows that this cannot be caused by lack of air pressure and that the same unexpected movement of power reserve engines has occurred; and further, that if with insufficient air pressure available a hand reverse engine does unexpectedly start to move the same can be controlled by using the hand reverse gear for braking purposes, which could not be done with a power reversed engine.

384 (d) In several serious accident cases steam connections auxiliary to power reverse gears have proven ineffectual after air pressure has been lost; and in many emergencies there has been want of sufficient time to make use of the power reverse gear for braking purposes. Instances have occurred where pipe connections of power reverse gears were broken and the engine had become uncontrollable either by brakes or the reversing gear. Power reverse gears at times become inoperative through accidents to the auxiliary steam connections, such as freezing or destruction of packing within gear cylinders, in consequence of which some railroads have discontinued their use.

(e) Serious injuries to employees have been caused by operation of gears of both types striking or catching a man of whose position of danger the operator was unaware. The engineer using hand reverse gear can more readily detect danger and prevent accidents of this character than one using power gear. The evidence discloses only minor injuries of this character on hand gear locomotives, but five deaths on those equipped with power gear.

(f) As an engineer does not ordinarily reverse his locomotive while in motion, no danger is involved when he brings his head inside the cab to reverse at a standstill; the use of hand reverse gear does not substantially interfere with observation of signals or keeping a lookout.

(g) The "creeping" or unintended movement of the reverse mechanism and valve gear which the Commission found causes no accidents, does cause many and serious accidents and injuries as well as destruction of property. The evidence shows that at least one death was so brought about and probably another, together

385 with several severe injuries. This tendency to creep is peculiar to power reverse gears, and reasonable maintenance of the apparatus is not sufficient, as the Commission holds it is, to overcome it. The view of the Commission that proper maintenance will prevent "creeping" in the case of power reversed engines is equally

applicable to manual reverse gears, especially to those instances where the lever latch jumps out of the quadrant notch due to wear of the parts.

(h) The great majority of injuries sustained on engines equipped with hand reverse gears were of minor character and resulted in temporary disability only, the large majority being trivial and causing only a few days' lost time. On the other hand, nine deaths are shown to have resulted from operation of locomotives equipped with power reverse gears, and a considerable number of permanent and serious personal injuries also so resulted.

(i) Oral evidence before the Commission showed approximately the same number of accidents causing personal injuries resulting from the use of each of the two types of gears. Documentary evidence consisting of form T accident reports for 1929 and 1930 showed 216 accidents from hand reserve gears and 16 from power reverse gears, but many accidents of the latter type were not included in these reports.

Injuries shown by oral testimony from hand reverse accidents caused permanent disability in two cases, the remaining being much less serious, though there were several hernias and cases of broken bones. At least 18 of these were the result of indiscretions or neglect on the part of the operator, or failure in maintenance and inspection of the gears. On the other hand, nine deaths resulted from accidents due to power reverse gears, and several permanent in-
juries, fractured skull with seventeen months' lay-off and an
386 award of $10,000, amputated arm, and eight other cases of injuries very severe in comparison with those occurring on hand-controlled apparatus. The 216 injuries shown on form T reports, in connection with hand gears, were minor and in no case involved permanent disability. In only three of them was the injured person off duty more than 60 days, and over two-thirds resulted in from 4 to 15 days' lost time.

In considering the comparative number of accidents shown by the record in connection with the two types of gears the Commission gave no effective consideration to the comparatively more serious character of injuries, deaths, and property damage resulting from the use of power-equipped locomotives. On the contrary, it based its fact finding by counting or tallying the injuries attributable to hand-operated gears, on the one hand, and to power gears, on the other; in effect giving the same consideration to a slight or temporary injury as to a serious or permanent one, when comparing the merits as to the safety of the devices. See Automatic Fire Door Case, 151 I.C.C. 448, 464, where the Commission approves the statement: It does "not matter how many minor injuries you have, you could not have enough of them to counterbalance one death."

(j) Power reverse gears were neither developed nor applied to promote safety. They have been preferred by the carriers because of restricted cab space in the more modern locomotives of enlarged

boiler capacity. They take up little room in the cab and may be readily installed in such limited space, where it would be awkward if not impracticable to use the hand lever. Increased width of fire box and boiler head and increase of appliances for use by the enginemen are features of design increasingly present within recent years.

The preference of the carriers for power gears on their modern
386½ locomotives is due to these modern conditions, rather than to promote safety, and is no evidence of their insincerity in opposing complainants' demands. In several respects power reverse gears do not make for safety as much as does the hand reverse gear, although the locomotive equipped with either type of gear proper installed and maintained is in proper condition and safe to operate without unnecessary peril to life or limb.

(k) Complainants' evidence before the Commission shows an average of one injury for each 25 years of active service, and but two of these were serious enough to permanently retire the engineer. 125 witnesses for defendants with an aggregate of 3,852 years of locomotive service suffered four minor injuries or an average of one for each 963 years of service. The 216 form T report injuries applied to 31,597 manually equipped engines during 1929 and 1930 show an average of one accident per year for approximately 300 locomotives.

(l) The more modern locomotives with wide fire boxes and limited cab room are the types where the principal difficulty in the matter of clearances has been experienced, but upon these types power reverse gears have already been voluntarily applied by the carriers. Improper clearances on manual reverse gear locomotives may readily and inexpensively be made ample by changing the location of appurtenances in the cab so as to provide more room. Accidents attributable to insufficient clearances which appear to constitute the majority of accidents relied on by complainants, are preventable thereby.

(m) The manually operated screw reverse gear occasioned fewer accidents than any other type, and no evidence is in the record tending to prove that such gear is unsuitable or unsafe. Approxi-
387 mately 1,550 locomotives are so equipped. The evidence shows only three minor accidents in connection therewith in 1929 and 1930.

(n) But three injuries are shown of record on locomotives equipped with obsolete types of power reverse gears. Many accidents occurred in connection with locomotives equipped with power gears of the latest type, which operate on the same general principle as the earlier types.

(o) Many of the most severe injuries to employees working outside the locomotives were due to eccentricities and trickiness of operation of power reverse gears caused by their intricity, or temporary insufficiency of power available on the engine, the latter being a circumstance not always detectable. From these conditions dangers arise to passengers and the general public, and not only to the enginemen.

(p) Both types of gears have been in use by the railroads for more than twenty years. And prior to the complaints no claim was made by complainants, carriers, or manufacturers of power reverse gears, that the substitution of power for the hand reverse gear would promote safety.

Considering the number of locomotives in operation, the possibility of accident through the use of hand reverse gear equipment is slight and the risk of serious injury thereby very remote. The use of this type of equipment is not attended with any unnecessary peril to life or limb.

The conclusion of the Commission that safety of employees and travelers on railroads requires steam locomotives to be equipped with power reverse gear is substantially unsupported by the evidence before it.

(5) The report shows on its face that the Commission failed
388 and refused to consider uncontradicted evidence submitted by the railroads of their precarious financial condition and the necessity of conserving their cash and credit to meet current operating expenses and fixed charges in order to continue to maintain and operate their properties with safety to their employees and the public. The Commission failed to give heed to the outstanding facts of the general depression and the inroads upon railroad revenues of motor and water competition; it failed to consider difficulties of financing under such circumstances and the cost of complying with the order, and expressly grounded its order upon expected future improvements and financial conditions not shown of record or true in fact.

## CONCLUSIONS OF LAW

Based on the foregoing findings of fact we conclude as matter of law:

1. This suit is properly brought in this district and is one of which the court has jurisdiction.

2. The report of the Commission adequately meets whatever requirements may exist for a statement of conclusions of fact in view of section 14 (1) of the Interstate Commerce Act.

3. Upon the questions raised by petitioners as to the Commission's jurisdiction and authority to entertain the complaint and to amend existing rules as here undertaken, we feel bound by the decision of the United States Supreme Court in Napier v. Atlantic Coast Line et al., 272 U.S. 605, and conclude that the Commission had jurisdiction and authority to proceed as it has done.

4. In its consideration of the case and in the making of its report and order, the Commission acted arbitrarily, unreasonably, and
389 unlawfully by failing and refusing to consider and give legal effect t opertinent, substantial, and uncontradicted evidence in the record before it having an important and controlling bearing upon the issue under consideration by the Commission, in the several respects set forth in the foregoing findings of fact.

5. In its consideration of the case and in the making of its report and order, the Commission reached conclusions and acted contrary to the indisputable character of the evidence before it, and hence arbitrarily, unreasonably, and unlawfully, as pointed out in said findings of fact.

6. The report and order of the Commission here assailed are arbitrary, unreasonable, and unlawful because unsupported and unwarranted by an substantial evidence in the record before the Commission, as indicated by said findings.

7. Unless the said order be vacated, set aside, and annulled, and its enforcement perpetually restrained and enjoined, petitioners and the other railroads represented by them will suffer irreparable injury and will have no adequate remedy at law.

8. Said order should be vacated, set aside, and annulled, and its enforcement perpetually restrained and enjoined.

S. H. WEST,
JOHN M. KILLITS.

391 In United States District Court for the Northern District of Ohio Eastern Division

[File endorsement omitted.]

In Equity No. 4681

THE BALTIMORE & OHIO RAILROAD COMPANY ET AL., PETITIONERS

*vs.*

UNITED STATES OF AMERICA, INTERSTATE COMMERCE COMMISSION ET al., defendants

*Decree*

Filed Feb. 5, 1934

On June 19, 1933, this matter came on to be heard before a court of three judges constituted and convened under sec. 47, tit. 28, U.S.C., and consisting of Honorable Samuel H. West, district judge, who called to his assistance Honorable Smith Hickenlooper, circuit judge, and Honorable John M. Killits, district judge. Thereupon came the parties by their counsel and the cause came on to be heard upon the petition and application for a temporary restraining order and interlocutory injunction, it being stipulated by the parties in open court that said cause be also heard and determined upon the merits. Thereupon the same was heard upon the pleadings, evidence, and arguments of counsel; and the court being duly advised in the premises, rendered its opinion herein per curiam; and having made and filed its findings of fact and conclusions of law, upon due consideration thereof, it is now

Ordered, adjudged, and decreed that the order of the Interstate Commerce Commission dated January 5, 1933, made in the proceeding entitled A. Johnston, grand chief engineer, etc., et al., versus Atlantic Coast Line Railroad Company et al., docket no. 24050, as supplemented by amendatory orders of January 28, March 18, and June 20, 1933, described in the petition, be, and said order as thus amended is hereby, vacated, set aside, and annulled, and the enforcement thereof by the Interstate Commerce Commission or otherwise, perpetually enjoined. To all of which defendants and intervenors except.

S. H. WEST,
JOHN M. KILLETS,
*District Judges.*

392 In United States District Court

[File endorsement omitted.]
[Title omitted.]

Petition for appeal Filed March 5, 1934

The United States of America, defendant, and Interstate Commerce Commission, A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, intervening defendants, in the above-entitled cause, feeling themselves aggrieved by the final decree of the District Court of the United States for the Northern District of Ohio, entered in said court February 5, 1934, pray an appeal from said decree to the Supreme Court of the United States.

The particulars wherein they consider the decree erroneous are set forth in the assignment of errors, accompanying this petition and to which reference is hereby made.

Said defendants pray that a transcript of record, proceedings, and papers on which said decree was made and entered, duly authenticated, be transmitted forthwith to the Supreme Court of the United States.

Dated February 23, 1934.

ELMER B. COLLINS,
*Solicitor for United States of America.*
DANIEL W. KNOWLTON,
*Solicitor for Interstate Commerce Commission.*
E. B. FREED,
*United States Attorney, Nor. Dist. Ohio.*
HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,

393 *Solicitors for A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen.*

394 In United States District Court

[File endorsement omitted.]

[Title omitted.]

*Assignment of Errors*

Filed March 5, 1934

Now comes the United States of America, defendant, and Interstate Commerce Commission, A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, intervening defendants, by their respective counsel; and in connection with their appeal, file the following assignment of errors upon which they will rely in the prosecution of their appeal to the Supreme Court of the United States from the final decree of this court entered February 5, 1934.

The district court erred:

1. In holding and determining that the function and power of the Interstate Commerce Commission in a proceeding such as here involved were the same as or comparable to that of a jury in a case at law.

2. In holding and determining that the said Commission failed to give proper weight to the evidence before it, or any part thereof or to the substance thereof, and in holding and determining that the Commission ignored competent evidence and disregarded any established standard respecting the weight of the evidence.

3. In holding and determining that there was uncontradicted evidence in the record before the Commission which the Commission ignored or used in violation of its true import.

395 4. In holding and determining that the Commission did not fairly consider all of the pertinent and substantial facts presented to it.

5. In holding and determining that the weight of the evidence did not justify the order of the Commission.

6. In undertaking to make and in entering upon a determination upon conflicting evidence of the fact questions presented in the case before the Commission, and thus exceeding its proper authority and function and assuming those of the Commission.

7. In reviewing the determination of the said Commission on the facts, and in substituting its judgment for that of the Commission in respect of a matter, the determination of which is vested in the Commission.

8. In holding and determining that the Commission's action was arbitrary and in disregard of its duty.

9. In entering a decree setting aside the order of the Commission and restraining its enforcement.

10. In not entering a decree dismissing the petition.

Dated February 24, 1934.

ELMER B. COLLINS,
*Solicitor for the United States of America.*

DANIEL W. KNOWLTON,
*Solicitor for the Interstate Commerce Commission.*

E. B. FREED,
*United States Attorney, Nor. Dist. Ohio.*

HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,
*Solicitors for A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen.*

396–397 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order allowing appeal*

Filed March 5, 1934

In the above-entitled cause, the United States of America, defendant, and Interstate Commerce Commission and A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, intervening defendants, having made and filed their petition praying an appeal to the Supreme Court of the United States from the final decree of this court in this cause entered February 5, 1934, and having also made and filed an assignment of errors, and a statement of jurisdiction, and having in all respects conformed to the statutes and rules of court in such case made and provided, it is

Ordered and decreed that the appeal be and the same is hereby allowed as prayed for.

Dated March 1934.

S. H. WEST,
*United States District Judge.*

398 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Notice to the Attorney General of the State of Ohio*

Filed March 7, 1934

*To Honorable John W. Bricker, Attorney General of the State of Ohio:*

Pursuant to Urgent Deficiencies Act of October 22, 1933, 38 Stat. 221, you are hereby notified that the defendant, United States of America, and the intervening defendants, Interstate Commerce Commission and A. Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, have taken an appeal to the Supreme Court of the United States from the final decree of the United States district court, entered February 5, 1934, and the order allowing the appeal makes the same returnable within forty days from the date hereof.

ELMER B. COLLINS,
*Solicitor for the United States of America.*
DANIEL W. KNOWLTON,
*Solicitor for Interstate Commerce Commission.*
E. B. FREED,
E. B. Freed, *United States Attorney, N.D.O.*
HAROLD N. McLAUGHLIN,
THOS. STEVENSON,
*Solicitors for A. Johnston, Grand Chief Engineer, of the Brotherhood of Locomotive Engineers, and D. B. Robertson, President of Locomotive Firemen and Enginemen.*

Service of a copy of the foregoing notice is hereby acknowledged this 28th day of February 1934.

JOHN W. BRICKER,
*Attorney General, State of Ohio.*

399 [Citation in usual form showing service on Alfred P. Thom, Jr., filed March 5, 1934, omitted in printing.]

400–402 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order enlarging time within which to settle the record*

Filed April 3, 1934

It appearing that the record is voluminous, consisting of the transcript of the record of the evidence and proceedings before the Inter-

state Commerce Commission containing 6,400 typewritten pages of oral testimony of numerous witnesses and 109 exhibits, and that additional time is necessary in order to afford plaintiffs-appellees opportunity to check the narrative and to agree to the settlement thereof.

It is ordered, That the time be, and the same is hereby, enlarged to and including July 15, 1934, within which there may be prepared and presented to the Court for approval in narrative form as required by equity rule 75 (b) a statement or narrative or a revised statement or narrative of the oral testimony and such of the exhibits as are not reproduced in their entirety, all as contained in the certified copy of the transcript of the evidence and proceedings before the Interstate Commerce Commission and introduced in evidence in the
403 District Court in this cause.

S. H. WEST,
*United States District Judge.*

APRIL 3, 1934.

All parties consent to the entry by the United States District Court of the above order.

March 27, 1934.

ELMER B. COLLINS,
*For the United States.*
DANIEL W. KNOWLTON,
*For the Interstate Commerce Commission.*
NYE F. MOREHOUSE,
*For Petitioners.*
HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,
*For A. Johnson et al., Interveners.*

E. B. FREED,
*United States Attorney.*

Copies furnished Harold N. McLaughlin and Thos. Stevenson, attorneys for A. Johnston et al., this 2d day of April 1934.

404 In United States District Court

*Order enlarging time within which to settle the record*

July 6, 1934

It appearing that the record is voluminous, consisting of the transcript of the record of the evidence and proceedings before the Interstate Commerce Commission containing 6,490 typewritten pages of oral testimony of numerous witnesses and 109 exhibits, and that additional time is necessary in order to afford plaintiffs-appellees opportunity to check the narrative and to agree to the settlement thereof.

It is ordered, That the time be, and the same is hereby, enlarged to and including August 1, 1934, within which there may be
405 prepared and presented to the Court for approval in narrative form as required by equity rule 75 (b) a statement or narrative or a revised statement or narrative of the oral testimony and such of the exhibits as are not reproduced in their entirety, all as contained in the certified copy of the transcript of the evidence and proceedings before the Interstate Commerce Commission and introduced in evidence in the District Court in this cause.

S. H. WEST,
*United States District Judge.*

JULY 6, 1934.

All parties consent to the entry by the United States District Court of the above order.
June 30, 1934.

ELMER B. COLLINS,
*For the United States.*
DANIEL W. KNOWLTON,
*For the Interstate Commerce Commission.*
NYE F. MOREHOUSE,
*For Petitioner.*
HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,
*For A. Johnston et al., Interveners.*

407 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order extending time for filing transcript of record in the Supreme Court of the United States*

Filed April 9, 1934

Upon application made and for good cause shown,
It is ordered that the time for filing the transcript of record in the above case in the Supreme Court of the United States, in the city of Washington, District of Columbia, be extended from April 14, 1934, to and including July 15, 1934.

JONES,
*United States District Judge.*

Approved:
HUGH MCNAMEE,
*Asst. United States Attorney.*
APRIL 9, 1934.

409 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Order extending time for filing transcript of record in the Supreme Court of the United States*

Filed July 13, 1934

Upon application made and for good cause shown,
It is ordered that the time for filing the transcript of record in the above case in the Supreme Court of the United States, in the city of Washington, District of Columbia, be extended from July 15, 1934, to and including August 15, 1934.

S. H. WEST,
*U.S. District Judge.*

Approved:
MARC J. WOLPAW,
*Asst. United States Attorney.*

JULY 12, 1934.

410 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Stipulation re transcript of record*

Filed July 20, 1934

On the hearing of the application for a permanent injunction, the petitioners offered in evidence a certified full copy of the transcript of the record of the evidence and proceedings before the Interstate Commerce Commission in the proceeding entitled "Docket No. 24050, A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers v. Atlantic Coast Line Railroad Company et al.", consisting of a total approximately 6,500 pages of the oral testimony of the witnesses and approximately 109 exhibits and the same having been received in evidence by the court, and the defendant and intervening defendants having seasonably filed and served a condensed narrative of the transcript of the evidence and proceedings (in five sections) for the determination of the ap-
411 peal; and now for the purpose of reducing and settling the record on appeal pursuant to equity rule 75, the parties by their respective counsel (and with the approval of the court) stipulate:

(1) The within and attached narrative (in five sections) is a true and correct transcript in narrative form of all of the oral testimony introduced at the hearings before the Commission as the same is contained in the official typewritten transcript of the proceedings referred to.

(2) The narrative shall be substituted for the original transcript of the oral testimony so certified by the Commission, and shall be incorporated in the record on appeal and shall have the same force and effect upon the appeal as the original testimony.

(3) The exhibits in the certified copy of the transcript as narrated and summarized in section 5 of the statement of narrative, is a true and correct transcript and summary of the exhibits introduced at the hearings before the Commission as the same is contained in the official typewritten transcript in the proceedings referred to, with the exception that:

(4) Original exhibits before the Interstate Commerce Commission, nos. 3, 8, 9, 10, 15, 41, 96, and 97 shall be included in full under separate cover, 15 copies of these exhibits being bound together for the convenience of court and counsel, with like effect as if printed in full herein.

(5) The narrative and summary of the exhibits, as contained in section 5 of the statement of the narrative, shall be substituted for the original transcript of the exhibits certified by the
412 Commission, shall be incorporated in the record on appeal and shall have the same force and effect upon the appeal as the original exhibits.

ELMER B. COLLINS,
*Special Assistant to the Attorney General, for the United States.*

DANIEL W. KNOWLTON,
*Chief Counsel for Interstate Commerce Commission.*

HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,
*For A. Johnston, et al., Intervening Defendants.*

NYE F. MOREHOUSE,
*For Petitioners.*

Done this 20th day of July 1934.

Order

It is ordered that the within and attached stipulation and narrative be, and the same are hereby, approved; and in preparing, certifying and transmitting the transcript of the record to the Supreme Court of the United States the clerk is directed to proceed in accordance therewith.

S. H. WEST,
*United States District Judge.*

CLEVELAND, OHIO, *July 20, 1934.*

413 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Præcipe for transcript of record*

Filed March 5, 1934

*To the Clerk:*

Please prepare a transcript of the record in the above-entitled cause for the purposes of the appeal herein filed and allowed, including therein the following papers and proceedings, to wit:

1. Petition and exhibits A, B (parts 1 to 4, inclusive) and C thereto attached, omitting appendix to part 1, and appendix A and appendix B to part 4 of exhibit B.
2. Answer of United States of America.
3. Intervention of Interstate Commerce Commission.
4. Answer of Interstate Commerce Commission.
5. Petition for leave to intervene of A. Johnston and D. B. Robertson.
6. Order allowing intervention of A. Johnston and D. B. Robertson.
7. Answer of A. Johnston and D. B. Robertson.
8. Petitioners' exhibits 1, 2, 3, 4, 5, 6, and 7.*

414 9. Notation of oral stipulation in open court that case be taken as submitted on final hearing.

10. Opinion of District Court.
11. Final decree.
12. Petition for appeal.
13. Assignment of errors.
14. Order allowing appeal.
15. Notice to attorney general of the State of Ohio.
16. Citation on appeal.
17. Statement of jurisdiction of Supreme Court, together with notice and acknowledgment of service.
18. Præcipe for record.

ELMER B. COLLINS,
*Solicitor for United States of America.*
DANIEL W. KNOWLTON,
*Solicitor for Interstate Commerce Commission.*
E. B. FREED,
E. B. Freed,
*United States Attorney for N.D.O.*
HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,
*Solicitors for A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen.*

* To be reduced to narrative form pursuant to equity rule 75 (b) and covered by a stipulation to be approved by the parties when that work is completed.

Service of a copy of the above præcipe for transcript of record is hereby acknowledged this 24th day of February 1934.

ALFRED P. THOM, JR.,
*Solicitors for Petitioners-Appellees.*

415 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Præcipe for additional transcript of record*

Filed March 5, 1934

*To the Clerk:*

Pursuant to equity rule 75 appellees (petitioners) request that the transcript of record in the above-entitled cause, for the purposes of appeal herein, include the following papers and proceedings in addition to those specified in the præcipe for transcript of record heretofore filed on behalf of appellants:

1. Order entered May 31, 1933, constituting a special court to consist of Judges Hickenlooper, Hahn, and West.
2. Order entered June 3 (8), 1933, substituting Judge Killits for Judge Hahn as a member of said court of three judges.
3. Written stipulation between petitioners and the defendant, United States of America, as to the elimination of exhibits 26 and 27 before Interstate Commerce Commission.
4. Journal entry of June 19, 1933, showing case heard and
416 submitted on that day on final hearing pursuant to stipulation of all parties.
5. The court's findings of fact and conclusions of law filed January 30, 1934.
6. Præcipe for additional transcript of record.

NYE F. MOREHOUSE,
*Solicitor for Appellees (Petitioners).*

417 In United States District Court

[File endorsement omitted.]
[Title omitted.]

*Additional præcipe for transcript of the record*

Filed July 20, 1934

*To the Clerk:*

In addition to the documents included in defendants' and intervening defendants' original præcipe for transcript of the record on appeal and in petitioners' additional præcipe filed on or about March 3, 1934, please prepare and include in the transcript of the record in the matter of the appeal of the United States and others in the above-entitled cause, in the order given below, the following matter, viz:

418 (1) Order enlarging time until July 15, 1934, for preparing narrative of testimony and exhibits pursuant to equity rule 75.

(2) Order enlarging time until August 1, 1934, for preparing narrative of testimony and exhibits pursuant to equity rule 75, filed July 6, 1934.

(3) Order extending time for filing transcript of record in the Supreme Court of the United States, from April 14 to July 15, 1934, entered April 9, 1934.

(4) Order extending time for filing transcript of record in the Supreme Court of the United States, from July 15 to August 15, 1934, entered July 13, 1934.

(5) Stipulation of July 20, 1934, including narrative of testimony, together with exhibits submitted to the Commission and introduced in the District Court, and order approving the stipulation.

(6) Fifteen copies (bound together) of original exhibit nos. 3, 8, 9, 10, 15, 41, 96, and 97, introduced before the Interstate Commerce Commission, included in their entirety. These 15 copies will dispense with the necessity of printing in the record the exhibits referred to.

(7) This additional præcipe.

ELMER B. COLLINS,
*Special Assistant to the Attorney General.*
DANIEL W. KNOWLTON,
*Chief Counsel, Interstate Commerce Commission.*
HAROLD N. MCLAUGHLIN,
THOS. STEVENSON,
*For A. Johnston et al.*

Service of the foregoing additional præcipe for transcript of record and the receipt of a copy thereof are hereby admitted and acknowledged this 20th day of July, 1934.

NYE F. MOREHOUSE,
*Solicitor for Petitioners.*

419 [Clerk's certificate to transcript omitted in printing.]

1 In United States District Court

No. 4681–E

*Narrative statement of the evidence before I.C.C.*

Filed July 20, 1934

Washington, D.C., May 11, 1931

Before Examiner John L. Rogers.

STATEMENT

We will take up this morning Docket No. 24050, A. Johnston, grand chief engineer, Brotherhood of Locomotive Engineers, and

others, against the Atlantic Coast Line Railroad Company and others (T. 13).

*Appearances*

H. M. McLaughlin for complainant, A. Johnston.

G. W. Laughlin for complainant, A. Johnston.

Thomas Stevenson and Timothy Shea for complainant, D. B. Robertson.

A. P. Thom and A. P. Thom, Jr., and Nye F. Morehouse for the American Railway Association.

M. G. Roberts and J. W. Murphy for the St. Louis-San Francisco.

Ben B. Cain and C. A. Miller for designated short lines.

W. B. Rodman for the Norfolk Southern.

S. S. Alderman for the Southern Railway and other Southeastern lines.

Arthur Van Meter for the Monongahela Railway et al.

Henry J. Hart for the Bangor & Aroostook Railway.

Nye F. Morehouse, also for Chicago & Northwestern Railway.

W. J. Larrabee for the Delaware, Lackawanna & Western.

A. R. McDonald, Madison, Wis., for the Railroad Commission of Wisconsin, intervening in support of the complainant. (T. 13–14.)

*Statement by Examiner*

By complaint filed by A. Johnston, Grand Chief Engineer of the Brotherhood of Locomotive Engineers, and D. B. Robertson, President of the Brotherhood of Locomotive Firemen and Enginemen, it is alleged in substance that defendant carriers are using steam locomotives which are not in proper condition and safe to operate in the service to which the same are put, and without being so equipped that they may be used without unnecessary peril to life and limb, in violation of the Boiler Inspection Act, as amended. These conditions arise, it is alleged, because the locomotives are equipped with manually operated reverse gear, instead of power operated
2 reverse gear. The commission is asked to require defendant carriers to equip their steam locomotives with reverse gear operated by power, or other devices adequate to protect the employees thereon from unnecessary peril to life or limb.

Mr. McLaughlin agreed that that was a substantial statement of the issues. (T. 14–15).

*Motions to dismiss*

Mr. Thom announced the authorization by two short lines for the A.R.A. to represent them in this proceeding. He also stated that he had in the course of preparation a supplemental answer for filing, which would modify paragraph 5 of the original answer, in which there was an admission as to a power reverse gear being practical for use. The answer also sets out in detail the carriers'

objection to the procedure, and asks dismissal on the ground that the Commission lacks jurisdiction. This supplemental answer shows what the carriers think the procedure ought to be. Mr. Thom made a formal motion to dismiss on behalf of the carriers generally, and Mr. Miller on behalf of the short lines. Mr. Miller then stated for the record the view of the short lines as to the procedure which should be followed which is not detailed here, because it is not evidence (T. 15–28; also 36–38).

Mr. Rodman joined in the motion made by Mr. Thom (T. 28).

In support of Mr. Thom's motion to dismiss, Mr. Morehouse went into some detail on the jurisdictional question, not set out here because argumentative (T. 28–36).

Upon being asked by the examiner as to whether, outside of this technality, Mr. Miller saw anything that was not fair and thorough about the procedure being followed, he said that he thought "it is absolutely unfair in any case to proceed in any matter where any tribunal does not have jurisdiction." If the thing had gone through the Chief Inspector, and he had acted, and it was up to the Commission, Mr. Miller said he saw nothing wrong about following a procedure such as this. The only link that Mr. Miller saw missing was that the Chief Inspector had not acted, which he said was a condition precedent to the Commission's acting (T. 38–39).

The examiner overruled the motions to dismiss, to which an exception was noted (T. 42).

FRANK STONE, a locomotive engineer employed by the Chicago & Alton, was sworn, and testified as follows:

DIRECT EXAMINATION

I have been in the service of the C. & A. about 26 years and during that time, in addition to occupying the job of locomotive engineer, have been road foreman of engines from 1913 to 1920. I acted as master mechanic from 1920 to 1922. I have been running an engine for 26 years and my experience is in all classes of service. My territory runs from Roodhouse, Ill., to Kansas City, Mo., and at present I am running in local freight service. In that service we use consolidated locomotives, the weights on drivers of which range generally from 170,000 to 200,000 pounds. They are equipped with hand reverse gear. In freight service we also have the lighter locomotive known as the "Mogul", 2–6–0, and a heavier type, known as "Mikado" 2–8–2; the weight on drivers of the former running between 140,000 and 170,000 pounds, and on the latter 214,000 pounds. The Mogul type are equipped with hand reverse gear, and a very few of the Mikado class have the power reverse. The rest have hand reverse.

In passenger service in that territory we use what is known as the 10-wheel type slide valve, Pacific type, 4–6–2, piston valves. The

weights on drivers of the Pacific class run between 170,000 and 200,000 pounds. Very few of them have power reverse gears; the others are hand reverse. The pinwheel engines, with an average weight on drivers between 140,000 and 170,000 pounds are hand reverse (T. 43–45).

In switching service in this territory we use the Consolidated engines with the boilers moved on the frame. That is all of the difference. The 2–6 is one class, and then we have a heavier type switch engine the same as the Mogul, or, rather, the Consolidated. They are equipped with hand reverse. Our locomotives in all classes except the heavy Mikado are equipped with the Stephenson link motion. The Consolidated type engine are equipped with the Baker-Pillod valve motion. The lighter power and the pinwheel passenger engines have slide valves (T. 46).

The reverse lever on all locomotives on our railroad, whether Walscheart, Stephenson gear, hand reverse or power reverse, is placed as conveniently in the cab as possible, fastened at the lower end with a bolt or stud, the length of the reverse bar anywheres from four feet to six feet. I am describing the manually operated reverse lever. The lower end of this reverse bar swings on a fulcrum bolt or stud located some place in or about the frame of the engine extending parallel in the cab. The upper part of the reverse lever in the cab travels along what is known as a quadrant. This quadrant is notched. It has notches in it one-half inch deep and one-half inch apart. A dog is fastened on the reverse lever arranged to slide on this reverse lever up and down and hold the lever latched in the quadrant. Most of our power, all of our power having this reverse lever, have a coil spring above the dog or latch on this reverse lever to hold the latch in place in the quadrant. About half-way between the lower end of the reverse lever and the quadrant latch a reach rod is coupled into this reverse lever by a pin, the reach rod extending forward to what is known as the tumbling shaft arm, a top arm. This tumbling shaft is held to the frame on the right and left sides of the engine. Between the frame and on this tumbling shaft are two arms extending forward or backward, as the case may be—forward on our engines—about anywhere from 15 to 18 inches, with pins and levers hanging to the link saddles. I was giving you the Stephenson gear—one on each link, with a pin that the hanger is coupled to. Inside of this link is a link block. This link block is coupled by a pin through the lower rocker arm and the rocker box is held in place on the frame by a box bolted to the frame. The top rocker arm is coupled to the valve road by pin, then to a sleeve coupling to valve stem, then through your steam chest to a yoke that goes around your valve. With the Stephenson gear, all parts are moved by the operation of the lever, but the object of the links, link lifters or tumbling shaft arm, is to lift the link. In so doing you change the position of the valve that admits steam to the cylinder. These links are very heavy. It is necessary to use a counterbalanced spring

to enable a man to handle his valves through the links. On some of our types of engines we have an eliptic spring or flat spring composed of two leaves, a long and a short, with a band in the center. Sufficient tension is put on this spring to carry or equalize the weight on your links, meaning you could pull your lever to the center with no effort to speak of. As you throw your lever forward compressing the spring naturally there is more weight as you go forward, dropping your links and compressing the spring. As you run by the center to your rear travel the weight becomes heavier for the reason that you loosen the tension on the spring, whether it be coiled spring or eliptic spring. With the Walscheart valve motion there are differences in the parts to be moved or lifted by the operation of the reverse lever. Instead of moving your link you move the link block. Your movement of the reverse lever is practi-
6 cally the same. It is coupled in the same way with reach rod, tumbling shaft arm, and hanger to your radius bar. To change the motion it is necessary to lift your block in your link instead of lifting the links. There is far less weight on the Walscheart for the reason you have simply the weight of your link block and your radius bar as against the links on the Stephenson gear and hanger.

As to how the operation of the Baker-Pillod gear as to what parts are moved when you reverse the lever compare with the ones I have described, the operation of the reverse lever is the same in so far as your reversing forward and back, or vice versa. But the Baker-Pillod that we have on our railroad is the older type. In fact, I am not sufficiently familiar with that type to give you the correct names of your bell cranks, and so forth. But your motion is transmitted through bell cranks. There is very little difference as between operating that as compared with the Wallscheart (T. 46–50).

The height of the reverse gear extending from the floor board of the locomotive differs on different engines; some are higher than others, but they range 20 to 24 inches above the floor board. On most of our engines the entire bar will have about 4 feet from the floor board. The reverse bar is made of steel. On the particular engine that I have, the reverse bar in going from the front to the rear of the quadrant has a five-foot sweep. Your reverse lever is located as conveniently as possible in the cab, but with your space between your boiler, which extends halfway through your cab, you do not have to exceed 20 inches between the outside of your cab or window to your boiler—about 20 inches. And your reverse lever and quadrant are as close to the boiler as will give the necessary clearance, which is two inches on all nearby piping during that movement; that is, the movement of the lever (T. 50–51).

7 On the engine I am running it is necessary for me to stand up when I want to reverse the engine. I catch the reverse bar at the latch, draw the latch out of the quadrant, and move the

bar backwards to extreme motion, completing an arc of about 4 or 5 feet (T. 52).

The usual operations that are performed with the reverse bar on a typical freight run east out of Kansas City are as follows: You get on your engine and place the reverse bar at the extreme back of the quadrant so as to back over a switch. The switch is thrown, and you reverse your engine by placing the lever in extreme forward motion and proceed through the yard. A switch is thrown, and you then back in on your train. In starting the train you place your lever in extreme forward motion. When you get up a speed of 45 (4 to 5) miles an hour you unhook your reverse lever latch and pull the lever toward the center, shortening the stroke of your valve, which is what railroad men call "hooking up the engine." As the speed increases, you pull your reverse lever nearer to the center of the quadrant and continue this operation until you get the engine working at the economical cut-off. The purpose of pulling the lever closer to center is to save coal and water by shortening the stroke of the valve, thereby allowing live steam to follow your pistons only a certain distance, whereas on full stroke the live steam follows the piston for its extreme travel. The short stroke works the steam expansively. After traveling one-half mile it is necessary to drop the lever down a couple of notches and lengthen the stroke on account of climbing a hill. At the top of the hill, which is one-half mile long, you shorten the valve travel. If the track is clear, you run in this position for two and one-half miles, crossing two interlocking plants. You then run into another hill, and it is necessary to drop the lever to about half stroke. In climbing this hill, which is about three miles long, it is necessary to move your lever at least two or three times toward the extreme travel. About halfway up this hill there is more level track, and it is customary here to again shorten the valve travel for about one-half mile. You again run into the grade near the top end of the hill, which requires dropping the lever a notch or two until you have passed over the hill. This performance will continue over the entire 95-mile division. Different trips are different. The slipping of your engine has the effect of slowing down the train and makes it necessary to increase valve travel. I imagine that you handle the reverse lever at least 30 to 35 times in the first 25 miles (T. 52–55).

8

The operation of reversing the engine from forward to back motion is very simple with the engine standing with no steam. It differs when you have steam pressure on your valve or around your valve. It is no little effort to reverse an engine that is dry or with a broken valve, a rough valve, or dry pins or bushings in your reverse gear. Dry valves are caused by different reasons. An improperly fitted valve ring, cylinder-packing blow, valve-ring blow, improper lubrication, due either to the lubricator failing or being fed too light, or water washed over the valves. Dry valves makes the reverse bar handle harder because of the dry-

ness and friction that is caused between the ring and your valve chambers or valve seat. With the Walscheart gear your link block, tumbling shaft boxes or connections, reach rod or reverse lever, all pins and connections, if dry, will cause the engine to handle hard. There are about 15 or 16 bearings in the Walscheart motion between the piston valves and the reverse lever in the cab and more such bearings in other types of valve gear (T. 55–57).

From my experience as road foreman and master mechanic I can say that these bearings and connections are kept in as good shape as possible. All oil holes are kept open, but any time during the trip one cinder will stop an oil hole, causing friction in this bearing. These oil holes throughout the entire gear are supposed to be looked after each trip. It very often happens that a new bushing is applied, and the bushing is so turned that the oil in the box and bushing do not come in line, and then it is impossible to get any oil on that bearing until it is corrected. You cannot find this unless you remove the bushing. Friction in these bearings will cause the rigging to move harder (T. 57–58).

It is very common after a gear has run a number of months that you will pick up slight wear in each one of these bearings, which causes a continual rattle or pounding on your reverse-lever latch. As the rattle continues your reverse-lever latch will creep, due to the wear of the latch and quadrant notches near to the top of the latch, and will drop to the corner. I have had this happen. There is a hazard connected with the lever dropping to the corner; if you happen to have your foot in the way of lever or reach rod it will catch your foot. As to the force connected with the lever going to the corner, the weight of the entire valve with the steam is against you, plus the weight of your links, as the minute she is unlatched she will drop forward. It goes too quick for you to catch it (T. 58–59).

I have had experience with water foaming; by that I mean when the water raises from the water level carrying it out through the throttle, steam and dry pipe to the valves and cylinders. This destroys lubrication and causes the lever to jump and rattle, necessitating holding the lever until you can get the cylinders lubricated (T. 59–60). Under these conditions, after the lever is dropped to the corner, it is impossible, while working steam or at a speed above 20 or 25 miles an hour, for one man to pull that lever back to running position. Should he attempt it he is liable to injury. In such cases it is necessary to reduce speed or get the assistance of the fireman and sometimes the brakeman. A man might be injured by getting the lever started from the extreme forward motion and part way back, and before he could let loose from the latch the lever would be yanked forward again (T. 60).

Our locomotives have foot braces at the end of the quadrant in order that you might brace yourself in pulling the lever back. I generally use this brace in hooking up the engine while running. On some engines I have placed my foot against the feed pipe or injector or the end of the cab, which was the more convenient way to brace

myself. It is not necessary to call on the fireman for assistance in moving the lever unless it goes to the corner at high speed, barring the condition of the engine when she comes from the shop. It very often happens that when an engine comes out of the back shop that all new bushings and boxing are so tight with new valve rings it is impossible to handle the engine with any degree of safety (T. 60, 61).

I am now on a local run, doing switching or station work, and it is necessary for me to sit facing the reverse lever in the window of the engine in order to see to the front and rear. Upon receiving a stop signal I stop the engine and then it is necessary for me to come inside of the cab, stand on my feet and reverse the engine and then look out the window for a signal. When I am in the act of reversing the engine I am inside the cab and cannot see conditions on the ground or have an eye on my train (T. 62, 63).

11 A local freight will do station switching and spotting as much as 20 minutes to 3 hours at each station, and during such period you will average reversing the engine every minute during the time you are there. In this service you do not have the same amount of hooking up or dropping down the lever as on a through freight run, because you seldom have a tonnage train on a local, but if you have much of a train you change your cut-off quite often (T. 63–64).

In passenger service, on leaving your terminal you will gradually, as you pick up speed, shorten the travel of your valve by moving the lever, and there may be three or four movements from the time you leave the station until you get up your speed. You leave the lever in that position until the next stop, except where you receive a flag, a slow order, slow board at the foot of hills, or stock on the track, or a flagman, or an automatic signal against you (T. 64, 65).

It was my duty as road foreman to instruct engineers with reference to the use of the proper cut-off, and in observing them handling the lever I found they could not at all times shorten the cut-off while sitting on the seat box. It was necessary or had become a habit for them to brace themselves, so that if the lever kicked or jerked they would not be injured. They cannot keep their attention on their lookout duties while performing that operation, and engineers generally cannot keep a lookout ahead while so doing. My own experience is that it cannot be done except for a very short distance ahead of the engine, as you are looking through the front window, downward on our type of locomotive (T. 66).

12 As to the time it takes to handle the lever in dropping it down, if you unhook the latch it will go to the corner right suddenly. It takes two or three movements sometimes to locate the latch in the desired notch. You are changing the position of the lever generally at slow speed, except when you are endeavoring to shorten the stroke at high speed. I would be unable to say how far the engine travels during the time I am giving attention to the lever. If it goes to the corner, I make it a practice to wait until we are on straight track or nearing a block signal to see the position of the

signal before making an attempt to bring it back to position. On occasions when the fireman has to assist me we are both in there wrestling with the lever. In passenger service there is no other man on the engine, and in freight service there are times when the engineer and fireman are the only persons on the locomotive. I am 56 years old (T. 67–69).

I was injured by the operation of a manual reverse bar on December 8, 1930, near Fulton, Mo., on engine no. 347, a Mogul type of locomotive weighing between 140,000 and 170,000 pounds on drivers used on a mixed run, passenger and freight. On this locomotive the latch at the top of the manual reverse lever had a very wide spread, requiring the use of both hands when you wanted to reverse the engine. I made a report of this, and the company, after making two corrections in the working of the latch spring, had taken some of the tension off the spring, and this lever had jumped from its place five or six times before I was caught during this trip. It had become a habit for me to hold the latch while running between stations. After doing some station switching at Fulton, I proceeded and had brought the lever back to working notch over a grade.

13 A brakeman standing in the gangway called to me, and I turned around, and as I did so I had to let go of the latch on the lever, and I threw my foot up on the lower end of the quadrant, and about the same time the latch flew out of the quadrant, and the lever went to the extreme forward motion, catching my heel. I had on a high-top shoe, and it ripped the shoe from the top to the bottom of the stiffening. I had to pull the lever back before I could release my heel. I released my foot and stepped over the quadrant, as it is directly in the path of the way out of the cab to the deck, and as I did so I noticed I felt dizzy, and I called to the fireman to catch me. But before doing this I applied the brake. When I came to, the train crew and the fireman were there, and they helped me from the cab to the ground, and the fireman, who is an engineer, pulled the coach up that was back several cars from the engine and with the assistance of the brakeman and conductor, I got into the coach and came to our home terminal, Mexico. The engine was running not to exceed 10 or 12 miles an hour at the time. I was off duty as the result of this injury from the 8th of December until, I think it was, the last of February. I have no effects from the accident at the present time except that I limp (T. 69–73).

I have had experience with the Ragonett type of power reverse on our Mikado heavy freight and Pacific type passenger engine. By means of air power it lifts the link and moves the valve, so that the engineer does not have to handle that part of it. The part of the mechanism in the cab is a reverse lever not to exceed 12 or 15 inches from top to bottom, and a quadrant of about 10 to 12 inches from extreme forward to reverse position.

14 The sweep of this lever would not be over 15 to 18 inches. The lever is fitted with a latch. The air cylinder is hung on a bracket outside of the cab between the tumbling shaft arm and the

cab. The tumbling shaft and other mechanism of the valve motion is moved by a piston in the air cylinder. The air cylinder piston is operated by a slide valve, which in turn is controlled by the hand lever in the cab. As to the relative strength required to operate the power reverse mechanism and the hand reverse, there is no comparison. With hand reverse it is necessary for the man to exercise the amount of strength necessary to lift the link and move the valve, whereas with air reverse the air piston moves the valve. Two fingers will operate the air reverse lever. With our gear it takes from a half minute to a minute for the air to equalize in the cylinder in reversing the engine. Power reverse is arranged in the cab so that it is easily reached from the seat box or any other position in which you might be. It takes little or no room, and there is no danger of striking your legs or body. It is not necessary to change your position while looking out of the cab window to reverse an engine equipped with power reverse if properly installed (T. 73–77).

I am talking about the Ragonett gear (T. 77).

As master mechanic my duties were to see that the power was maintained in as nearly 100-percent condition as possible by examining the work reports made by engineers and inspectors, and the work performed by the mechanics. I had supervision of the work done in the shop, on the western division 252 miles. From my experience in performing those duties I will say that we experienced no trouble whatever in keeping these power reverse gears in shape.

15 From my experience as an engineer in operating the gear I can say that we have had very little trouble with power reverse creeping and discovered it was due to the soft packing in the air reverse cylinder. So far as I know this trouble has been overcome. By creeping I mean the piston going forward a little and back a little while the engine is in motion. This does not create any hazardous condition to the man in the cab (T. 78–79).

If the locomotive upon which I was injured had been equipped with power reverse I am of the opinion that there would have been no possibility of being injured, because it would be impossible for me to get my foot or hand anywhere around the reverse gear that could have pinched me. None of the mechanism of power reverse is near the floor where my feet or legs might be (T. 80–81).

CROSS-EXAMINATION

It has been my experience that with power reverse it would be impossible for you to have an accident of that kind; your power reverse does not jump out of the quadrant as does the hand reverse. I have had experience with power reverse off and on for three to five years as an engineer. The greater part of my experience has been with the hand lever (T. 82).

The power reverse lever is smaller and shorter than the hand lever, and the quadrant is smaller and shorter and the notches in it finer

and smaller than in the case of the hand lever. The notches in the power reverse quadrant are about one-eighth of an inch deep. I spoke of the links and other parts of the Stephenson gear being very heavy, but I cannot tell in pounds how much these parts weigh. It is the engineer's duty before leaving the terminal, and during the trip whenever he has an opportunity of getting down, to look after the lubrication of the valve, link block, tumbling shaft, and the various bearings in the valve gear mechanism.

16 The different parts of the gear mechanism you lubricate by hand with an oil can. As to the bushings of which I spoke having the oil hole turn downward, that is a very infrequent occurrence and does not happen daily because the bushings are not renewed daily. In many instances they run several months or a year without changing. We have a type of bushing which has a groove along the outer surface so that no matter which way it is turned the oil will go down. That overcomes the particular difficulty to a certain extent, but it is possible for these oil holes to be stopped up any time after you leave a terminal or before you get in. Possibly they will not be cleaned out until somebody discovers them by accident. When you are lubricating you may notice that the top of the oil hole will be open, and you drop oil into the hole but it may not reach the bearing. I believe they use hair packing for the oil holes on our heavier type of engines, and that would take care of the lubrication up to the time that all of the oil would run out of this hair or waste. There would be no oil get to the bearing until the oil hole was cleaned out (T. 83–86).

In case the different bearings in the valve mechanism and the valves in the steam chest become dry or are improperly lubricated, you soon find that out by the difference in operating and handling the manual lever, and you can observe this more quickly with the hand gear than with the power gear (T. 86).

On our locomotives we have hydrostatic lubricators located in the cab, of three to six pints capacity. The lubricator is fed by steam pressure and hangs on a bracket at the top of the boilerhead at the highest possible point so there may be direct piping with a gravity feed to the steam chest or steam pipe. You are instructed to start your lubricator 25 or 30 minutes before leaving time, as that

17 length of time is required to heat the lubricator so as to feed the oil through the choke and get to the valve. The engineer upon discovering his valves are dry will immediately increase the speed of the lubricator. There is a sight feed indicator in the cab where you can see the drops, and you set these drops so your allowance will take you over the division. If you feel in the operation of your hand lever that the valves are beginning to get dry you immediately increase the speed or the drops, and that increases the lubrication in the valve after so long a time. If you want to get immediate results there is only one way, and that is to shut off your throttle and open your feed wide open. That lowers the pressure

in the cylinder and the boiler pressure behind the lubricator carries whatever oil is in the pipes immediately down to the valve. I cannot agree with the statement that with the hand lever you are in a position to discover that situation and to rectify it a great deal more quickly than with power gear. An engineer who has had any experience can tell by the handling of the train and by noticing his engine going lame if the valves are going dry, that is, after it becomes quite dry. There is a tendency for the hand reverse to show dryness before the power reverse will in the way of rattling, but the speed of the train will show that very nearly as quickly, and also the regularity of the exhaust. I don't know that there will be much difference between the power and hand reverse in detecting this. I don't know that you could discover much by the lever other than the losseness of your pins and bushings, and that would show up in the locomotive being out of square (T. 87–90).

There must be a certain amount of looseness in the latch of the reverse lever. It cannot be a tight fit. Due to the looseness
18 you have to start with, and the continual raising and lowering of the latch in and out of the quadrant notches, there is a wear, and it will gradually become looser. It is like the wearing you get on the cogs of two wheels or two gears that mesh into each other and rounds off the edges a little bit; as the lever latch is dropped into place from different angles it has a tendency to wear. If it gets worn to the point where an engineer can see that it will jump out or not hold it is his duty to report that on his work report. It is the duty of the master mechanic to put the mechanism back into proper shape. I have reported this quadrant and latch as an engineer, and have had it repaired as master mechanic. The repairs were made by renewing the dog or dog bolt and having the wear on the lever taken up as much as possible. I don't recall any cases where the quadrant was renewed except where the teeth had become broken out. It is surprising how the wear will show on the constant dropping in and raising of that latch. I have had cases where the constant rattling and pounding of the valves against the reverse lever would cause the dog or latch to raise just a little, and perhaps it would take a half mile or a mile or two miles before that had raised sufficiently to let the lever go to the corner. It has become a habit for me to run that engine with my hand on the reverse lever latch so that the weight of my hand presses down on the lifting part of the latch. The lifting part of the latch extends out diagonally, probably 30 to 60 degrees from the upright part of the lever, and should be sufficient for a compression of one inch. If there is an unusual amount of pounding you feel the impulse on the hand lever, but that is not always due to lost motion. It can be the dryness of the valve or the broken rings, or in the distribution of steam. The matter of a broken valve ring is a frequent occurrence, and on one of our heavy Mikado engines it is very common to break a valve ring every trip.

19 Broken valve rings do not happen very often unless there is some defect to cause it. It is one particular engine I am trying to describe that causes this trouble (T. 91–95).

In the case where I got my heel caught I would not have been hurt if I had not been around the lever. I had been holding the lever and I let go it at the same time the brakeman called me, and turned round to look at him. The latch was down, the locomotive was going 10 or 12 miles an hour. The quadrant and latch were not worn. It was practically a new engine, and it had not been out of the shop long. I am satisfied that I had gotten the latch fairly engaged in the quadrant, although I did not make any personal examination of it at that time. The quadrant was out of line and not in a proper radius, and I had asked the company to relieve the tension on the spring which holds the lever latch. The lever had jumped out five or six times during this particular trip, which was the first trip after the tension on the spring had been lessened. I don't recall of having that difficulty on previous trips with this locomotive. Prior to that time the spring worked too hard. I wanted to have the spring released so I could handle it with some assurance. I did not run this locomotive after the accident and do not know what they did to correct this condition. I made a work report, part of which was to cause the tension on the spring to be lessened, before the accident, and an accident report afterwards (T. 95–99).

From the location of the seat on this locomotive, which is between the outer side of the cab or cab window and the quadrant, there is insufficient room between the lever and the cab for your body. You can imagine how close it would be where you have to turn sidewise to pass between the lever and the window, and there are possibly three and not to exceed four inches from the lever
20 to the boiler as the lever travels parallel with the boiler. It is about twenty inches from the boiler to the side of the cab, and that leaves approximately sixteen inches between the quadrant and the side of the cab where my feet are. As I turned on the small seat with the lever right at my side I simply threw my foot up into the path of the lever and threw it over into the end of the quadrant, out of the space where I ordinarily keep it (T. 99–100).

We have blow-off cocks, and a soda-ash compound we use in our water (T. 101).

The manual bar is stiff when the locomotive comes out of the shop, and until you get the bushings worked in you have to have some help, and also when she becomes dry. Going above twenty miles an hour if you want to put the lever back to running position you cannot do it without help at all times by easing off the throttle and hooking it up two or three notches at a time. You can very often do better by simply easing off on the throttle not too much speed, and jerking until you start it, and then come back a couple notches at a time until you get beyond the point where it is binding.

On the occasions when going in excess of 25 miles an hour it is necessary to have the assistance of the firemen is not a frequent occasion, but I have had it happen perhaps a couple of times a week and then again not for a month. As to whether that had anything to do with the particular locomotive I will say no, unless it had some renewals of some kind. It is the weight of your valve with the engine in motion that holds it in that position. If there is anything that causes the lever to jump out of the quadrant I report that on my work report (T. 101–102).

21 On the locomotive on which I was injured the seat consisted of a board, probably 12 or 13 inches wide, that had an iron post set under it to hold it up. There wasn't room for a seat box. It was a drop seat just the same as on hinges. I normally sit comfortably in a position with my feet before my facing ahead while running between stations (T. 102–103).

While switching at stations I cannot sit on the seat because it would be impossible for me to reverse the engine without getting up and walking forward, as my regular engine has a five-foot sweep of the bar from one extreme to the other. As you are continually crossing over public crossings in the town it is necessary that you and the fireman keep looking both ways, and to make it easy I will sit in the windows. When I am standing in an upright position the window will come about to my shoulders. It is necessary for me to get up to reverse the engine because of the extreme length of the travel it has, and in order that I might see back and be sure of my signals. We have a stationary arm rest in a bracket outside of the window, and, in sitting in the window, I sit on the sash and arm rest with my head outside as much as I can. I found I could not manipulate the lever, watch my signals, and sit on the seat. That does not apply to all of the power on my railroad. It refers to the Consolidated engine weighing between 170,000 and 200,000 pounds on drivers I am running today, but this Consolidated class of engine is not the only class where it is necessary to place myself in that position in switching and yard work. The 2–6–0 on which I was hurt, and another type of freight engine, have the same condition (T. 103–106).

22. I never timed the speed of moving the gear from one end of the quadrant to the other either with power or manual reverse. I know you can use power reverse much quicker than you can the hand reverse under normal conditions. With the hand lever there are times when you can move it apparently with no difficulty, if there is no steam around your valve. Then there are times when you make two or three hitches before you get your lever over, and very often it is necessary to open the cylinder cocks to release the pressure, and that is what requires the time (T. 106–107).

With the hand lever you do not have occasion to throw it from one extreme of the quadrant to the other when you are working steam, but with a super-heated engine you are working steam after the throttle is shut off, and it is a matter of two or three lengths of the

locomotive to exhaust the super-heated steam, and in switching you can't make two or three exhausts until you have gone the length of the engine. It depends upon the circumstances of the particular case. You might be able to throw it over with ease if you are not working steam, and the super-heater pressure were not against you. In case you were drifting and with no steam pressure in the chest it would be a simple matter to reverse it (T. 107–108).

The counterbalance spring can be adjusted to any desired strength by tightening or loosening a nut on the end of the bolt which holds the washer back against the end of the spring. The greater tension you have on the spring the easier it is to lift the lever, but there is a limit to that. It is not custom on our road for the engineer to adjust the spring. He reports it and has the roundhouse or shop force do that work (T. 109).

23 I have had no experience with power reverse gears other than the Ragonett. When I was master mechanic we did not have them on very many locomotives. We have perhaps a half dozen all told now. My experience running with them has just been an occasional trip covering possibly three or four years. I have never had a regular engine equipped with that gear. I stated that so far as I knew they had eliminated the tendency to creep from questioning different men and listening to different engines that had this type of gear as they went by. I can tell by listening to them if their speed was not too high by the change of exhaust. You will get a very loud exhaust and then maybe not any, and then two or three. The lever in the cab does not move down and back. It is just the piston in the cylinder. I have not heard of any of that trouble now for some time (T. 110–111).

The foot brace I use when I operate the reverse lever extends out from the quadrant toward the cab window, perhaps three to six inches or more (T. 111–112).

I have been operating about thirty years or more as an engineer on the Chicago and Alton, and the Chicago & Northwestern. I cannot think of any accident I have had due to my failure to see a signal or a highway crossing because I was operating a hand reverse gear. I have been very fortunate (T. 112–113).

On the through freight run from Kansas City I operated a Mikado engine with Walscheart motion weighing 214,000 pounds on drivers. On the local freight runs I have today I am operating a Consolidated engine with Stephenson motion weighing 170,000 to 200,000 pounds on drivers, and on the mixed trains I operated a 2–6–0 engine with slide valves weighing 140.000 to 170,000 pounds on drivers. My testimony with respect to those runs was applicable and directed to those particular locomotives. They were manually reversed locomotives (T. 113–115).

24 As to what part of the difficulty with manual reverse could have been eliminated by proper maintenance of the quadrant or latch, I will say that our reverse levers, quadrants, and latches are kept as nearly as possible in a safe condition. When this engine

left the terminal she was considered to be in a safe condition. Any report the engineer makes is looked after as soon as possible. She was practically a new engine. The lever will jump out of the quadrant even with 100% condition of your latch and quadrant (T. 116–117).

When I testified as to the movement of the lever on a through-freight and local-freight run I had in mind all of the locomotives involved in that service and was giving you the average condition. As to my testimony where I had only one engine in mind, if I understood the question it related only to the trip on which I was injured (T. 117–118).

RECROSS-EXAMINATION

On the through run we have two classes of engines, the Mikado and one a little heavier, both weighing around 214,000 pounds on drivers. In local service we have different classes of engines, weighing from 140,000 to 200,000 pounds on drivers. They are not all superheated. My testimony is limited to locomotives weighing 140,000 pounds or more on drivers. Only two of the classes, those from 140,000 to 175,000 pounds and those from 170,000 to 200,000 pounds, are the older type. The Mikados are new, while the others were there when I went to work. I have had experience on the C. and N. W. with small four-wheel engines with slide or D. valve weighing 80,000 or 100,000 pounds on drivers equipped with hand reverse. There is very little difference in the strength required to reverse these engines as compared with that required on a larger engine of 140,000 pounds. We don't use these small locomotives in road service, just in switching service, and I do not recall that the lever ever jumped from the quadrant on this small locomotive. These smaller engines do not carry as high steam pressure as the modern type. This makes a difference in operating the lever. The higher the pressure in the steam chest the harder it is to move the lever. Train tonnage does not have anything to do with the ease with which the lever can be moved. With any type of engine the movement of the valve in the steam chest puts tension on the reverse bar. Any steam in the steam chest, either with piston or slide valve, causes the valve to pull hard at any and all times, and that pressure is communicated to the reverse bar under any and all conditions (T. 118–123).

Both the slide and piston valves are called balanced valves but that does not have a tendency to equalize the pressure. With the slide valve exhaust steam comes through a port in the center of the valve, and the live steam comes around the outside; with the piston valve it is the opposite. You ordinarily do not attempt to throw the lever over when the steam chest is full of steam, but if your brake is disabled you might do that to stop the motion of the engine. If the locomotive stops with steam in the steam chest, in most but not all cases you would open your cylinder cock and release the steam, but

you are not always in a position to open the cock. You have to come inside to do it, and with workmen on the ground you are in danger of scalding them. The so-called "balanced valves" are in fact not balanced. In my experience there is as much necessity for power reverse on small locomotives as on large locomotives (T. 124–125).

M. J. HUNT, a locomotive engineer, employed by the Delaware and Hudson Railroad Company, was sworn, and testified as follows:

26 I live at Oleonta, N.Y. I have been with the Delaware and Hudson since 1912 and had experience on other roads before that time. I am now in yard service at Oleonta, but am subject to calls from Wilkesbarre, Pa., to Whitehall, N.Y., and over branch lines. I have had experience in all classes of service, passenger, freight, and yard. In our yard we have the following types of engine: A manually reversed six-wheel connected engine, weighing about 130,000 pounds, on drivers which has a double cab which we call a Mother Hubbard; Consolidated engines of the Mother Hubbard type, weighing about 170,000 pounds on drivers manually reversed; and some Consolidated engines weighing about 200,000 pounds on drivers, not of the Mother Hubbard type, some with manual and others with air reverse, but at the present time they are using as nearly as possible all air-reverse locomotives. Until recently they had some Mallet compound engines. In our division in freight service they have the double-cab or Mother Hubbard engines, which have been converted into a single-cab engine, and then they have what they call the 1401, 1402, and 1400, the Henrietta Allen, the very latest and heaviest engine, and also the 1100's weighing about 300,000 pounds on drivers. Some of the Mother Hubbard engines are also used in freight service, all equipped with manual reverse. In passenger service on the branch lines they run the double-cab six-wheel connected engines with a pony truck, manually reversed. On through passenger trains they run some single-cab manually reversed and some double-cab manually reversed engines. On the largest engines, the Pacific type, I think these are all air reversed. Some of the smaller double-cab engines I mentioned on both short passenger runs and in the yard service, and also some of the 800s, are equipped with Stephenson motion. All of the smaller engines have slide valves (T. 126–129).

27 On the six-wheel connected Mother Hubbard engines I am running in yard service the clearance is very small between the lever and the gauge cocks on the back end, and the lever and the water glass pipes and cab on the front end. The gauge cock pipes and water glasses are located in different positions on different Mother Hubbard engines. On some the gauge cocks are on the front end, and on some on the back end. They are all mixed up. They are situated along the side of the boiler almost parallel with the reverse lever except it sits in a little different clearance. Some are a little

higher. The clearance between the lever and those gauge cocks and water glasses vary, but may be from two to six inches. I have quite often had part of my body or hand come in contact with those gauges. On some engines there is no clearance between the reverse lever and the seat. To get the lever over you have to drop your seat. You have to stand up in the cab to operate the lever. There is an iron strap bolted to the front end of the quadrant.

"By Mr. McLAUGHLIN:

"Q. If that strap should break or come out would anything happen when you are putting the lever into the corner?

"A. Well, not particularly in putting the lever into the corner, because you put it down there as a rule with care, but the reason the strap is there is if the lever jumps out of the quadrant when the lever is in motion.

"Q. What happens if the strap is not there?

"A. It is hard to tell just what would happen. Something would have to let go. You can't tell just what would happen.

28 "Q. Would the lever strike anything?

"A. I think it would in some cases, yes."

On the Consolidated engines we use in switching service they use the lever as I just mentioned. Some of them are bigger cab engines, but they are practically the same as I just mentioned. On the single cab engines the reverse lever is on the back end of the fire box and it sets on the right side of the engineer's seat. The clearance is very small on the front throw, that is, the pipe connection of the water gauge pipe and air brake pipes and different pipe connections on the front end. Quite often in throwing over the lever in the front position your hand will get jammed in there (T. 130–133).

In classification yard service on an active job possibly you will reverse that engine on an average of every thirty seconds. On a hump job with a manually reversed engine the chances are you would be reversing that engine on an average of every minute during the working period. There are three men operating this hump and you have to shove the cars up to the conductor to pull the pin, and of course they are dropping them off right along, and you have to go through that motion continually, and giving them a bump. We reverse that engine 28 times in a minute or a minute and a half, just as quick as I can throw it over and get it back again, trying to get that slack to shove up to (T. 133–135).

"By Mr. McLAUGHLIN:

"Q. Would you have time in hump service to open your cylinder cocks and clear the steam chest?

"A. Not on this hump. It would be a very dangerous thing, because there are switch tenders and men jumping all around there, and you might hurt some of them.

29 "Q. My question was whether you had time in this hump service to do that, or whether you can take the time to clear the cylinders of steam by using the cocks?

"A. If you had the time with safety. But 99 times out of a hundred you cannot open the cylinder cocks with that pressure in there.

"Q. But I am asking you when your train is on the hump whether you can take time and still perform the job of boosting these cars along?

"A. Well, you have to do that.

"Q. To take the time to open the cylinders?

"A. When you can't get the reverse lever over you are all tied up anyway. If you can't open the cylinder cocks you have to lay there until the pressure in the cylinder decreases so that you can throw it over (T. 134–135)."

In reversing a Mother Hubbard engine your position is naturally standing up, and your body has to be inside the cab to make the movement. For instance, we are backing up. On a back-up movement you get the signal and you have to come inside and get hold of the lever and throw it ahead or back, whichever the signal is, and then you have to put your body out of the cab to look back or ahead to see what signal is given. You are not able to keep your attention on the switchman or persons along the track while you are performing this operation on a double-cab engine. On a hard reversing engine I am sometimes accused of missing signals by the men on the ground. They come up and tell you they want to make a move but you are tied up and can't get the engine over. I have had signals changed on me while I was reversing the engine. I know that a signal was changed from what the men told me. I have had it happen a number of times while I was changing the movement of the reverse lever that they changed their minds, and I started in the direction of the last signal, and they would swing me up and say, "I want you to do so and so (T. 135–136).

I have had the experience in passenger service while running at high speed of having the lever go, notch by notch, from the center right down to the corner. I cannot recall that I ever had an engine in passenger service to jump right out on the jump, but they do what we call "creeping down." I got into the habit on this fast run and in fast freight with the hand lever so that I was always on the alert. I had so many close calls with the lever jumping out that I always run with a monkey wrench clamped right in between the lever itself and the lifting rod. That was a Consolidated engine. I have seen them jump in both freight and passenger service. They jump out of the quadrant right down to the corner. On a fast train, when the lever goes into the corner, you can't get it out. I wouldn't attempt to get it, nor I wouldn't advise any man to. On a yard engine I have had the lever swing back and forth in the quadrant. You would be in yard service and the bar would jump right out of the quadrant and go back and forth on you in the cab. That is a dangerous situation. It is difficult to tell the amount of force with which it was swinging. You have to grab it and try to clamp it in

the quadrant. It is difficult to explain that, because it would be going back and forth and you would have to get hold of it and get it clamped again in its position in the quadrant. There are various things which cause the lever to jump out of the quadrant, bad teeth in your quadrant, bad teeth in the ratchet, valves in
31 poor condition, valve cut, lost motion between the valve and reverse lever with the constant jerk will raise the teeth if they are worn, and that naturally gives the lever the throw of the valve right in the cab. I have never had any trouble with the engine working water (T. 136–139).

It is difficult to say how many times I regulate the cut-off on a passenger run of 10 or 15 miles, because the Delaware & Hudson is a mountain road and is a saggy and curving road, and you are dropping down and picking up the lever continually all of the time with a heavy train. When you have to do that you are not able to keep your attention on your lookout. You have to pull your body inside the cab, especially on a fast train, and on those Mother Hubbard engines you have to grab hold of your lever and brace yourself, and it becomes natural to an engineer in time to get a certain exhaust, and he will go around a notch at a time before you get the lever hooked up, and it will probably take ten, fifteen, or probably thirty seconds. The distance you would travel while running at 45 miles an hour during the time you are hooking it up depends upon the condition of the reverse lever. Some work well, some do not. It is a very dangerous thing on some of those engines to attempt to touch the reverse lever when you are going over 15 miles an hour. the condition of the reverse lever. Some work well; some do not. It takes a man with a lot of experience to regulate the reverse lever so it does not throw him through the cab when you raise the latch, because it will throw you if you don't get it in time (T. 139–140).

I was injured while operating a manual reverse geared engine on October 4, 1927, at Oleonta yard. It was on engine no. 1029, a single-cab Consolidated locomotive, weighing about 200,000
32 pounds on drivers. I was reversing the engine to make a back-up movement. The lever was on my left side, and to throw her over at any time you have to put your foot up against the boiler head and put all of your strength in your body to get it over. This engine was defective and had been defective for quite a while, and this particular time when I tried to get it over, the lever was just over the center and went the other way. I had a grip on it and it took me that way, and all of my ligaments in my back were torn loose and my side went dead on me for a long time. I was off duty for 133 days. After that accident I was not able to continue with the hand reverse lever. When the accidet happened I got over onto the fireman's side and he went to my side and ran the engine, and in a few minutes the pain got so terrific I had to lie down on the a deck of the engine and they had to take me off and put me in the yard office. From there they took me home. I stayed on the engine and in the yard office for pretty nearly an hour before they took

me home. I was in yard service at the time. This engine had been reported for over two months, and every engineer in the yard had reported this engine, and I myself in particular reported it every time I had it. I reported the condition of the reverse lever caused by leaky steam in the steam chest. That was the real direct cause of it. Every time I had this particular engine I would make a very plain report and tell the hostler to tell the roundhouse foreman and the master mechanic that someone was going to get hurt. I asked the hostlers if they had called the attention of those men to it, and he said yes, but they wouldn't do anything. When I came back to work I had an agreement with the management that they would put a power reverse engine on my run (T. 141–143).

33 On three different occasions since my accident I strained myself with manually reversed engines so that I was not able to stand up. On one particular occasion I had a Mother Hubbard engine weighing about 130,000 pounds on drivers. They had assigned this engine to a shop job just after it was out of the shop, and every time it would bind on a little bit of a curve it would take four men to throw it over. I called the brakeman and fireman into the cab to help me get it off the curve. I telephoned the roundhouse foreman and I think he put the master mechanic on the engine and I told him the condition, and he said if there was any way possible to work with it for about an hour and a half that he would get another engine. Rather than tie up the job I said I would do it. They made me work on that engine until midnight and never sent another one up. The link motion and all of the connections on this engine were tight. It was right out of the back shop. I have not noticed a bit of difference between the ease with which I can reverse a small engine of 130,000 pounds and one of the larger engines. Sometimes the smaller ones are very much harder to reverse (T. 144–145).

At the present time I am running with Ragonett and Alco power reverse. With respect to cab clearance those gears are situated so you can operate them O.K. and fine. The top of the lever handle is about 9 inches from the quadrant, and the movement over the quadrant is not over 15 inches. It doesn't require any strength to operate the power reverse lever except to get ahold of the handle, release the ratchet, and shove it back or ahead. This can be done probably with one finger after you release the ratchet handle,

34 and probably the movement does not take one second. The speed of reversing from forward to back motion is about one second in either direction (T. 145–146).

From my experience I would say that there is no comparison in the relative safety of power reverse as compared with hand-operated reverse, because there is no danger with the air reverse lever. As to the comparative ability to keep a lookout in switching service with air reverse you can keep a constant lookout. Even in back-up movements you can sit in any position in the cab and make the movements with the reverse lever. You don't have to take your eyes off the men you are working with. In road service while hooking up or drop-

ping down the gear with power reverse you are constantly looking ahead. You have your vision ahead of you and it requires no movement of the body except the hand. You either make your drop or pick up on your reverse lever. Your eyes are constantly on the track ahead of you and on the condition (T. 146–147).

I have had no difficulty with the power reverse becoming inoperative or creeping in the quadrant (T. 147).

If the engine on which I sustained my back injury had been equipped with power reverse, in my opinion the accident would not have happened, for the simple reason that it requires no exertion of your body to throw an air reverse engine over, and there is nothing there to injure you. The power lever is situated in such a way and it is so small that it is impossible to be injured on it (T. 147–149).

Additional appearances were noted as follows:

Mr. Toll R. Ware, 1025 La Salle Street Station, Chicago, Ill., appearing for the Chicago, Rock Island & Pacific and the Chicago, Rock Island & Gulf Railway Company.

35 Mr. Robert E. Quirk, Investment Building, Washington, D.C., and Mr. Thomas L. Ennis, 32 Nassau Street, New York City, N.Y., appearing for Delaware & Hudson Railroad Corporation.

Messrs. Willis Crane, Fayette B. Dow and Harry O. Elkins, 930 Munsey Building, Washington, D.C., appearing for Brown Company (Berlin Mills Railway) (T. 150).

Mr. Hunt continued his testimony as follows:

I will describe the mechanism of the Alco power reverse as follows: The reverse lever and quadrant are located in a handy position in front of the engineer in the cab. The lever has a throw of probably 15 inches or less. The lever itself is probably between 12 and 15 inches in length. It has a latch, a handle and small teeth in the quadrant. The quadrant is located probably three feet from the floor board. A reach rod is attached to the bottom of the reverse lever by a bolt and runs to the back cylinder of the air chamber. The reach rod runs along the outside of the boiler and the air cylinder is located on the front end of the fire box under the running board. The air cylinder is operated by a valve, which in turn is actuated by a movement of the reverse lever. This allows air to enter the air chamber and releases it. There is another reach rod on the front of the air chamber which runs to the top arm of the tumbling shaft which operates the movements of the valve through the eccentrics. I never timed this type of power reverse to find how long it takes to reverse the engine from forward to back motion, but I will go through the movement and you can see. There is the movement.

That may take a second and a half. The gear responds almost
36 immediately. As to how long it would be before the pistons in the air cylinder have changed from forward to back motion, I will answer by saying that it takes about the same length of time as it does to throw the reverse lever over. By the time you get your hand from the reverse lever to the throttle your engine is in motion.

If you are going into a go-ahead movement from a back-up movement you shove the lever ahead, put your hand on the throttle, open it up, and it is in motion (T. 151–153).

CROSS-EXAMINATION

In the Oleonta yard at the present time there are two regular jobs that have manually reversed engines and four regular jobs that have power reversed engines. The manually reversed engines are of the Mother Hubbard type, weighing about 130,000 pounds on drivers. They use these manually reversed engines on lighter work. The power reversed engines are heavier, weighing about 200,000 pounds on drivers. They include some old Mother Hubbard engines which they have converted into single-cab engines with power reverse. They include six-wheel, eight-wheel, and Consolidated engines, and they use them on the heavy jobs (T. 153–158).

When I testified previously that there was no clearance between the engineer's seat and hand lever I had in mind the Consolidated type of engine. They were that way in two classes which I ran This condition of lack of clearance exists only on the double-cab engine. They are the 800's and the 1000's. There are quite a number of the 800's on our division in way freight and yard service. They have sent all the 1000's to the Pennsylvania division. The
37 800's have a drop seat. The levers is along the left side of the engineer but the right side of the boiler. If you wanted to reverse your engine you would have to drop that seat because the seat when raised up is so close to the side of the boiler that there isn't any clearance. Your reverse lever would hit the seat as it came back. The seat on these double-cab engines, which is probably 18 inches by 18 inches, is located about the center of the boiler, on the side of the boiler. I know of a half dozen of these engines in active service on my division. As to their age, they are the oldest types of Consolidated engine on my division. They have older engines than these, but not of the Consolidated type (T. 158–163).

The strap which I referred to is a two-piece strap clamped right around the quadrant, a couple of inches or an inch back from the brace supporting the forward end of the quadrant. I think the purpose of putting on the clamp was to prevent the upper end of the lever from going closer than the prescribed clearance distance to the water and gauge cock pipes. Some of the engines have clamps and some of them have not. On the double-cab engines which do not have clamps there is two inches or more of clearance between the upper end of the lever and the pipe and boiler head and other appurtenances. The clamp prevents the valve and reverse lever from being moved too far forward. I imagine it was put there because the lever would jump out of the quadrant and would hit this strap before it went to extreme forward movement. It is a help for your valve, cylinder head, and cab. On some of the double-cab engines there is clearance even if the lever did go to the corner. The only danger in

my opinion is, and it is very dangerous, if the bolt on the back end of the quadrant should become loose at the time the reverse lever went to forward motion. This would loosen your quadrant
38 and let the whole thing go forward. The only danger is that one thing. Of course, there is danger for the engineer, provided he has hold of this lever when it jumps out, or provided his legs or feet, or something, are in line with the lever when she goes. I have had clamps come loose. I have never had the lever come up and break. I tightened it up when I found it was loose. One day I got caught. It was a good thing that my foot wasn't gotten. If it had been two inches or even an inch farther, the foot would have gone, but as it was it merely took the whole side of my shoe off, that is, the sole of it. For my own protection I keep my feet out of the way if I can. I do not think you could have a guard along side the lever so that the engineer could not inadvertently let his feet get in there. I don't think you could erect a guard of tin or meshed wire outside of the hole in the running board. The lever runs down to the fulcrum point underneath at the bottom of the reverse lever and that has to be clear in there for the lever to move back and forth. They have tried it but they were never a success in the operation of the lever. I tried it myself. The hole in the cab where the lever goes through is about three inches and the lever is about an inch wide there. We are in a cold country where it goes 20 and 30 degrees below zero, and with that hole in there with the wind and snow blowing it is so terrific that it gets as cold in the cab as it is outside at times, and we would take all kinds of methods to cover the hole, and when we wanted to use our lever we would have to take the guard off. I made the guard to keep the cold and snow out. The company also tried to do it. That is the only kind of a guard I have experimented with in connection with that lever. The company has tried to use a canvas cover in the winter to keep the snow and cold out on road locomotives. It is a piece of canvas
39 that follows the lever back and forth. I don't think that was a success. I haven't seen them on any of the locomotives lately at all (T. 163–169).

As to the time it takes for the Alco power gear to respond in reversing the lever I said this morning that I would go through the movement and you could time it if you wanted to. I estimated it probably at about a second and a half, and will let it go at that. As to whether I think that the air operation of the gear takes effect that fast I will answer, no (T. 169).

W. A. GREENWOOD, a locomotive engineer employed by the Delaware & Hudson Railway Company, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Green Island, N.Y. I was employed by the Delaware & Hudson in 1886 in shop service, and went on the road in 1890 and was promoted to engineer in 1902. At the present time my territory

covers Albany to Montreal. I have had experience as an engineer in all classes of service, and at the present time am in passenger service. I use a Pacific type of engine weighing 195,000 and 200,000 pounds on drivers, equipped with power reverse. On my division and on the road generally in passenger service we have Mother Hubbard engines weighing 165,000 to 180,000 pounds on drivers which are manually reversed, and I have had experience running those. On our division we have three types of freight engine. The first, the Mogul, weighing about 130,000 pounds on drivers, double-cab type, manual reverse, with slide valves. The next class is the 800 type, weighing 175,000 to 180,000 pounds, a Consolidated engine, some with hand reverse and some with power reverse. We have a heavier Consolidated engine weighing about 200,000 pounds, some of which are hand and some power reverse (T. 172–175).

40 On Mother Hubbard engines in passenger service I have had a number of instances where manual reverse levers flew out of the quadrant and went to the corner, and I had to slow the train down to about 10 miles an hour, or perhaps more, in order to get the lever out of the corner. This was due to some worn part of the reverse lever in the cab, such as, worn springs, weak springs, worn notches in the reverse lever latch or quadrant, or some strain in the valve motion, dry valve, tight fittings, or a bad spot in the rail causing the engine to settle to one side suddenly when the lever would fly out of the quadrant. For the purpose of preventing the lever from jumping out of the latch and to protect myself I have taken obstacles, such as, a driver brake shoe weighing about 30 pounds, and shoved them under the quadrant, so that if the lever did fly out it would not go to extreme forward motion and break off some of the appurtenances in the engine. On Mother Hubbard engines we have gauge cocks in front of the cab and some in the rear. It was not my experience but I have known where they went down to the corner and broke off the bottom cock of the water glass. There is danger in that kind of a break. A man could get scalded to death before he could get off the cab if they broke that top off with the doors shut. As to whether I have ever had occasion to hook up an engine when I am approaching a signal or highway crossing, I will say—not while approaching a highway crossing. You might shut off your steam and let the engine drift, but if you do you drop your reverse lever part way but not necessarily. As to my ability to keep a lookout at the time I am hooking up or dropping down the lever, there are times when it would take perhaps a minute or more, or a half a minute or more, when I have to take my eyes away from the front window in order to brace myself and reach for the

41 reverse lever. We have a brace on the floor where we brace ourselves, and while we are looking for this brace, especially in the night time, we have to take our eyes off the front window. There is danger in that because if you are going 45 or 50 miles an hour you can almost go two or three train lengths in twenty or twenty-five seconds, and you can go by a short flag or signal. Our

road is equipped with the train control from Albany to Rouses Point, 191 miles, and if you go by a yellow signal and do not acknowledge it in the cab, it automatically applies the brakes, and this causes serious delay because you have to get down on the ground and energize your mechanism again before you can start. You can do that while you are hooking up your engine with the manual reverse (T. 175–178).

I was injured by operating a manual reverse bar in Mechanicville yard on April 18, 1925, or 1926, on engine no. 807, a 2–8–0 Mother Hubbard type weighing between 165,000 and 175,000 pounds on drivers, used in through-freight service. This engine had the Southern valve gear, which is different from other motions, for the reason that the link lies flat and there is nothing to give there, whereas on the Stephenson and Walscheart motions the link moves. If this engine was on a curve or was not standing straight it would bind, and it was an impossibility for any one man to reverse it. You could get the lever from the forward corner up to center, but you could not get it past center in back motion. Sometimes they had to get a switch engine to move her off the curved track. On this day our train was standing on the main line and they were in a hurry to get away ahead of a passenger train. We had ample time, provided everything went all right. In attempting to
42 couple onto some cars, I tried to reverse the engine to make a back-up movement, and the lever bound on the center, and I couldn't get it into back motion. I called on my fireman for assistance, but he had gone to get a can of water, and the brakeman was back at the rear of the train, so I attempted to make the movement myself. I pulled and jerked and did everything I could to get it in back motion, but couldn't budge the lever. I put a piece of gas pipe about two feet long on top of the lever to get a better purchase but still couldn't budge the lever. I knew they were in a hurry to get out of there, so I got behind the lever and tried to push it, and threw my whole weight of 196 pounds on it. I got behind it and braced myself but couldn't budge it. The fireman then appeared and gave me a hand, and we finally got it into back motion. We immediately left ahead of the passenger train. I got very sick to my stomach. We had to go six miles further to get out of the way of the passenger train and made it. I had a severe pain in my left leg and left testicle. When we got off the double track I felt that I had a large bunch on my left side, and I was deathly sick to my stomach and couldn't move my left leg. I was assisted home from the terminal and was attended by the company surgeon, who advised me to go to the hospital, but he couldn't operate on me immediately, he had to go south. He attended me at his office and had me lay around two weeks until he came back. I was injured on the 18th of April and went to the hospital May 6th, and was operated on that day.

(Examiner Rogers ordered a short recess, after which the witness continued his testimony.)

I was off duty from April 18th until September 3rd. The company paid me close to $1,100.00 for time lost and hospital expenses. Blood poison set in after the operation, and they had drains in me for nine weeks (T. 178–183).

43 I have had experience with Ragonette, Alco, and Franklin precision power reverse. The parts of the Franklin precision gear which are located in the cab are just above my knee on the right hand side out of the way of everything. This gear is operated by a small wheel six to eight inches in diameter, which has a handle on it and works very easily. You can spin it around with one finger in either direction. The wheel is connected to a screw that works in between two guides, and the screw in turn is connected to a reach rod which leads to the tumbling shaft on the other end. There is an air cylinder which furnishes the force for the gear located outside under the running board. The only part of the gear which you can see in the cab is the screw and wheel. When you operate the wheel, that operates the piston in the air cylinder, either to forward or backward motion. It takes three or four seconds to reverse an engine from forward to back motion with this gear. With the manual reverse no matter how easily it works there is a lot of labor required to get it over. You have to reach with both hands and throw the lever back about five feet, whereas with air reverse I am sitting with my hand on the window and operate this little lever, which is about the size of an automobile brake, with three fingers. You can move it from the wrist and don't even have to move your arm if you don't want to. The precision gear is not as easily operated as the lever type because you have to do the screwing, but it screws very easily when they are taken care of. I have a precision gear on my train which is one of the heaviest and fastest trains on our system. I have been on this train for two years and eight months and

44 have never had an engine failure and have never had to report anything. It has never inconvenienced me in any way, shape, or manner. We have thirty-eight and forty degrees below zero in our country. I have never in that time had to make a report on air reverse. I can operate the precision gear and look ahead at the same time. The only thing we don't like about the precision gear is that in order to take slack we have to do a lot of screwing to get the motion in back motion, and while you are doing that your slack is running out at the other end. We do not have this trouble with the power reverse lever type. All you have to do is to come back with that little lever half the radius of the quadrant just over center and you have your slack, and throw it back and start off before the rear of your train moves, and thereby avoid shock on your train. We like the lever-operated power gear better than the screw reverse but they are both nice (T. 183–187).

I have had experience running double-cab switch engines weighing 125,000 to 130,000 pounds with slide valves, and have found them just as hard to handle with the manual lever as heavy-type engines. When they come out of the shop with new bearings and

tight fittings many times we have to get the brakeman and fireman to assist us with the small as well as the large engine (T. 187–188).

CROSS-EXAMINATION

My injury was due to an overstrain on my part. I had run that particular engine for more than a year, and had found it had an especially hard working lever. This engine is not in service any more. The management did away with that type of valve motion.

I attributed the hard working character of that gear to the
45 fact that it was a Southern motion, but we all know that a reverse lever is a device by which the engineer controls the valve motion, and all unusual or unnecessary friction, no matter where caused, is thrown on the reverse lever. I don't know of anything else on that locomotive that would account for that hard, stiff gear except the Southern valve motion. When the engine stood still before going out on a run it would not bind and you could throw it over easily. There was no give with this movement, and when we were going around curves the engine would get out of square and the strain would come on the reverse lever and shear off the pins. I used to carry extra cotter pins because the vibration and strain on the reverse lever would shear off a cotter pin in the latch in three round trips. The engine was standing still and was right on a frog when I strained myself. I don't believe we have any more of that kind of motion on our engines (T. 188–191).

We have block signals and automatic train control for 191 miles from Albany to the Canadian border. When we approach a yellow light it is an indication that the next one should be red. We are running perhaps at 60 miles an hour. I have to pull back the acknowledging lever and hold it back over 15 seconds, until we pass the light, and until a whistle in the cab blows, indicating that I can let go the lever. If I do not do this the brakes on the entire train are applied, we lose all our air, and have to wait six or seven minutes for the mechanism to pump up the air again. I have occasion to operate the hand reverse lever going at 60 miles an hour if I get a short flag or something unforeseen turns up and I drop it down part

way after shutting off the throttle. It is not necessary to
46 touch the lever if we want to come to a stop but we do it after shutting off the throttle to give the cylinders and valves a chance to cool off. I have had occasion where the train control signal was given to me and I was unable to respond to it. Our road is so crooked that when we come around a curve at 45 or 50 miles an hour we will not have three seconds to acknowledge the train control signal. On straight track we can see them for a quarter of a mile. We get no indication until we see the yellow light. It is very hazardous when running in a fog, when we cannot see two feet ahead of us. You have to keep your eye on the window every minute for fear you will get by one of the yellow lights (T. 192–196).

When I spoke earlier in my testimony of certain difficulties in handling manual reverse I referred not only to engines equipped with Southern type of valve motion but to all classes of valve motion (T. 197).

LEROY STUCKEY, a locomotive engineer employed by the Pennsylvania Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Alliance, Ohio. I am a member of both of the engine service brotherhoods. I was hired on the Pennsylvania in 1901, and promoted to engineer in 1910. My territory extends from Pittsburgh, Pennsylvania, to Crestline, Ohio. My experience has been principally in yard service, but I have been in freight service and handled passenger trains. I am now in yard service, using our H–8 and H–10, 2–8–0 engines weighing about 220,000 pounds on drivers, manually reversed. I also operate a I–1, 2–10–0 engine weighing 340,000 pounds on drivers, power reversed, a C–1, 0–80 engine weighing 280,000
47 pounds, power reversed, and a B–6, S–B, 180,000 pounds, six-wheel engine power reversed. There is another class of six-wheel engine the B–6 weighing 170,000 pounds on drivers, hand reversed, and some six-wheel engines the B–8's weighing 143,000 pounds on drivers, hand reversed, the B–6's and B–8's have Stephenson motion, and the B–8's slide valves (T. 197–200).

As to clearance around the lever on the H–8 and H–10 manually reversed engine weighing 220,000 pounds, and the B–6's weighing 170,000 pounds, which I referred to, the lever is on the right-hand side of the boiler and the left-hand side of the seat box. They have a drop seat. They have a long throw. They clear up pretty well, except that sometimes you will get your knuckles skinned between the lever and the boiler jacket in moving the lever back and forth. Some of them are a little bit close, but very few. Some seats are narrow enough so the lever will pass by, but the others are not and it will strike the seat (T. 200–201).

My work in the yard has been passenger switching, flat switching, and on the hump. I have to handle the lever a great many times. In flat switching I have not timed myself but I would say once every minute. Hump service is shoving cars up an incline and a man at the top cuts off a car to go to the various tracks. We just give one bump at a time (T. 201).

In yard service operating the lever sometimes takes all the strength you have, and sometimes the strength of two or three. It doesn't make any difference what sized engine it is. I have had the firemen and the brakeman come up and help. Hard handling is char-
48 acteristic of the hand-operated gear. The cases of hard handling are, valve rings inserted too tight, dry valves due to

leaky dry pipe, bad water conditions, and various things, too tight connections in the locomotive just out of the back shop. There are times when you have to reverse the engine with steam in the cylinders, due to the fact you cannot open the cylinder cocks because of men working around the front of the engine. There are occasions when the valves are stopped on center so that they cover the ports in the steam chest on one side. Our cylinder cocks are very good and generally open when you want to open them (T. 202–203).

I have difficulty in keeping a lookout for signals of the men on the ground while operating the reverse lever. You cannot see the men at all when you are handling the lever. You either have to move your position on the seat or get up and pull it over. This brings about a lot of difficulty, because there are times that the signal is changed after you make the movement from the signal you last received (T. 203–204).

The design of a piston valve results in pressure all around it but with the slide valve there is considerable pressure on top of it; that is, on the parts of the valve extending beyond the strips up against the pressure plate of the steam chest (T. 204).

I was injured in operating a manual reverse lever on August 3, 1926, in Canton yard on engine no. 9925, an H–8 Consolidated type engine weighing about 220,000 pounds on drivers. I was on a double header assisting another man out of the yard. We couldn't get the cars started and had to take slack. There was five or six men at the front of my engine, and I didn't dare open the cylinder cock, so I took hold of the reverse lever and put my foot on the
49 foot brace. Just as I was pulling the hardest my foot slipped off and I felt a peculiar sickening sensation. I reported to the yardmaster and to the company doctor who told me to go to the hospital. I had a lump on my abdomen as big as your fist. I was operated on for hernia and was in the hospital for something like a month. I was off duty three or four months. The company paid me $800.000 or $900.00 (T. 204–206).

I have had experience with Alco power reverse in yard service. There is no comparison in the amount of strength required to operate it as compared to manual reverse. You can move the power reverse with two fingers. As to the comparative speed of the two types of gear, on some of the old manual engines it would take you a half hour to get them over and some you can't get over. I have never had a bit of trouble with power reverse. I ran one engine for a year on the hump, and in that time I never had a failure and didn't have occasion to make a single report on the reversing mechanism. In my opinion, there is no danger of getting hurt with the kind of power reverse I have operated, but I will say there is danger with the hand lever. It is more dangerous with the hand lever (T. 206–207).

CROSS-EXAMINATION

My experience has been practically all in switching service, but I have operated power gears on an occasional road trip. I am 51 years old.

(Witness Greenwood here stated for the record that he was 60 years old and Witness Hunt's age was given as 55 years.)

Witness Stuckey continued testifying, as follows:

50 When I stated that in flat switching I had occasion to make some move with the lever once each minute I was making an estimate. As a rule when you do throw it in switching service you have to reverse the engine, although sometimes you regulate the cut-off, depending on the distance you have to go. My estimate is based on the frequency with which I am throwing it when actually engaged in switching work. Some part of the time you don't throw it that often, but we are generally moving on our road. We are allowed 20 minutes for lunch. As a rule we are going pretty steadily all the time (T. 208–210).

As to the changing of signals of which I spoke, on our road the switch foreman does not regularly change his mind, but for instance, we will say I kicked a car and the car was going and they gave me a signal to go ahead, I will answer that signal. After I get started ahead the car possibly did not run and I have to get inside the cab and change the motion of the lever, and by the time I get out I will see them swinging me down and wanting me to back up and put that car in the clear (T. 210).

When I spoke of taking a half an hour to reverse an engine I was not exaggerating. I have had locomotives from the Baldwin Locomotive Works where it was a physical impossibility for a man to reverse those engines when they were standing in a certain position. They were new out of the shop, stiff and tight, and the parts in the valve motion had to be broken in. That is true of all locomotives new out of the shop to a certain extent. They had been run from Philadelphia to Alliance, but I was using them in actual service.

51 REDIRECT EXAMINATION

When I get a power-reversed engine new out of shop I have no such difficulty in reversing it. I have had power-reversed locomotives brand new out of the shop several years ago. I couldn't tell you how much they had been used, but they were practically new. I have had cases of where my own power-reversed engine never had occasion to report a power-reverse gear (T. 210–214).

C. B. IRWIN, a locomotive engineer employed by the Pennsylvania Railroad Company, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Cabot, Pa., and am 58 years old. I was employed on the Pennsylvania as a fireman in 1899 and was promoted to engineer in

1902. My seniority district is from Alleghany to Connemaugh, and I am in freight- or mine-run service at the present time. My experience has been principally in freight service. In freight service we use a 2–8–0 locomotive weighing between 200,000 and 220,000 pounds on drivers manually reversed; also a 2–8–2 type weighing about 240,000 pounds on drivers, some of which have power reverse and others manual screw (T. 214–216).

The mechanism of the manual-screw gear, which is located in the cab, is placed right in front of the engineer on the right side of the boiler and extends parallel with the side of the boiler. It has a wheel about 14 inches in diameter, which operates a screw which is placed in front of the wheel and connected to it. The wheel has a crank handle with which you can screw the reverse either forward or backward. The screw is connected to a block that works in a guide. The action of the screw is carried to the link motion
52 by a reach rod connected to the tumbling shaft. The reach rod is about 14 feet long or more (T. 216–217).

We also have some power-reversed engines equipped with Alco gear 2–10–0 type weighing about 340,000 pounds on drivers (T. 217).

On our 2–8–0 engines the clearance is very little. You cannot sit on the seat box or stand up this way [illustrating] and pull the lever past you. There isn't room between the cab and the lever. I turn sideways with my back to the window and then bring the lever back. The lever will very seldom come in contact with anything on the side of the boiler. If it is in extreme back motion it is very much in the way of reaching the brake valve, and if you get in a hurry and are looking out the window and get a signal to stop quickly you might come in contact with the reverse lever when you want to reach for the brake valve and it would be much in your way.

With the lever type of gear it requires considerable strength to throw it from one end of the quadrant to the other. No boy can handle them; it takes a man to handle them, that is one thing sure. The sweep of the lever from one end of the quadrant to the other is farther than you can reach sitting down. From the experience I have had with the manual screw, it is very hard to reverse. You have to get up, and you haven't much room back of you. The cabs are very short back of you. You get hold of the wheel with both hands and crank that over eight or nine times in order to reverse the engine. The screw on power reverse is not like the manual screw. The power screw is about 14 inches across, and is a heavy wheel. The screw itself is about three inches in diameter. That screw
53 working in that block works very hard. You have to move the whole motion of that tumbling shaft and reverse that valve. Many times I have hit my knuckles on the window frame. It doesn't come in contact with anything on the other side. As to whether we can take our time in turning this wheel, everything in our service is production now. The wheel works very hard on many

locomotives. They have some that you could turn with one hand, but, again, you might run that engine for four or five hours on your trip and finally it would get so you could not turn it with both hands, or it would be all you could do to get it over with both hands. With the manual screw, when you operate the wheel you have to move all parts of the valve motion and tumbling shaft. I have never used screw-power reverse, but it would act on the same principle. With the Alco power reverse moving the hand lever in the cab does not move all parts of the valve motion, but just applies the air. The lever admits the air into the opposite end of the cylinder and throws the engine in reverse. It just applies the air. The wheel of the power reverse admits the air into the opposite end from which it had previously been and reversed the engine. It acts on the same principle as the lever. The difficulty of operating manual screw is caused by the fact that the thread on the screw is pretty heavy. You pull the reach rod quite a way at each turn of the wheel. I imagine the large thread would be harder to turn than smaller thread along with the other parts of the valve motion that come in contact with the motion of the screw reverse (T. 217–223).

I have not recently had any difficulty with engines just out of shop. The bearings were not any tighter than they should have been. We have very little experience with engines working
54 water except in dry spells when the water becomes bad and they will work water once in a while. That makes the reverse wheel harder to handle on account of the dryness of the lubrication (T. 223).

In mine run service our night's work practically consists of picking up and setting out cars at the different mines. I estimate that I will have to operate the reverse mechanism at least thirty times an hour in this service (T. 224).

I am not able to reverse either the manual bar or screw while sitting down. The screw reverse is in front of me but I have to stand up to reverse the engine. I am not able to keep my attention on the men on the ground while I am doing that (T. 224–225).

I was injured by operating a manual screw reverse on August 6, 1928, near Butler, Pa., in freight service on engine 259. I was reversing the engine when a strain caused a hernia and I was operated on and was off duty about three months. I do not know what caused the wheel to work hard on that occasion any more than at any other time. It had worked hard all night. The wheel did not catch me. The strain that was on the lower part of my abdomen caused the hernia, and the pulling of this wheel caused the strain. I have had very little experience with power reverse but have had some power-reversed engines and I have never felt any such strain with power reverse as I had on the occasion when I was injured. In my judgment it is not possible for power reverse to operate so as to cause such a strain (T. 225–226).

CROSS-EXAMINATION

A signal to go ahead or backward is received from some member of the train crew on the ground or on some part of the train.

55 I usually get the signal by sticking my head inside and go through the operation of moving the lever to comply with the signal. While moving the lever I cannot keep my eyes on the man who gave the signal. As to whether there is any reason why I should keep my eyes on him, a man should observe at all times if he can. In case anything would happen between the time I got the signal to make a move and the time I was reversing the engine, I would not get that signal in case he gives it. As soon as I move the lever I stick my head out the window immediately and continue my observation. My attention is taken off the man from whom I am getting the signal just for the length of time it actually takes to move the lever. If we are getting the signal from a man in front of the locomotive, the only circumstances where we can see him through the front window with the engines we use are in case of a light engine. If we have cars ahead of the engine we have to get our head out of the window to see past those cars. In movements of this kind I have reference mostly to mine work or switching or picking up cars. My engine is usually standing still when I get my signal. I reverse it after it stops (T. 225–230).

On the occasion of my injury I couldn't find any fault with it as to what caused that gear to work so hard. I had not had experience with that particular engine before. It was the hardest gear to work of any I had ever gotten hold of. The engine was taken into the shop and an expert sent there to examine it; I can say what was done. I have never had experience with a hand-operated screw, threaded so as to cause a greater number of turns of the wheel in order to move the reach rod a given distance, and I don't know whether that would make it work easier or not. In operating the manual screw gears, I face the front end of the engine.

56 You would have your head down because if you raised up off the seat you would be stopped over this wheel.

"By Mr. MOREHOUSE:

"Q. Of course, when you are stooped over that brings your head right down in line with the front cab window, does it not?

"A. You would be looking down at the floor of the cab instead of out the window.

"Q. I am not asking where you are looking but the position of your face ahead with respect to the cab window. It is right on the line with the window, isn't it?

"A. Provided you are sitting up turned this way it would [illustrating].

"Q. You would have to lift your chin in order to look out?

"A. If you get this way [illustrating] you can't see out very well.

"Q. Unless you lift your chin and eyes to look out?

"A. Your head would be down too low and you couldn't do it, anyway."

As to whether it would be a physical possibility to look out of the cab window while I am stopped over turning that gear, I wouldn't say that I could do the work, handle a reverse gear of that kind, and still be watching out for signals. I couldn't do it. I can't say that I ever tried to do it (T. 230–233).

With reference to the occasions when the manual screw would operate with one hand at the beginning of a trip and would then get harder until it would take both hands, on those occasions I
57 have gotten down and oiled it when I had an opportunity, when I found the gear was beginning to work harder. The number 259 was one I could not do anything with. I have had quite a number of them when the screw reverse worked very hard, but I can't just give you the engine numbers now. I reported them on my work report. The work would be up to the shop force and I wouldn't know what was done because I wouldn't get the engine for perhaps two or three weeks or a month. I remember one other engine which I reported, and then took out a trip or two after that, and it still worked hard and I reported it again. I can't say just now whether I can recall other instances of that kind (T. 233–235).

I had never had a hernia previous to the one I received reversing my locomotive. I went to the hospital and was operated on. As near as I can tell you it was caused by the continual pulling I did on that gear which worked so hard on that particular day, the same as any overexertion might cause a hernia by any heavy or continuous strain. I made out an accident report and gave as the cause the reversing of the engine (T. 235–236).

REDIRECT EXAMINATION

I can operate a power reverse lever and at the same time keep a lookout on my track and over my train (T. 236).

RECROSS-EXAMINATION

With the lever type of power reverse I can stick my head out of the window while I am moving the reverse lever. I pull that lever either way I want to while I am still sitting on my seat. With the power lever it is not my practice while we are doing work to pull my head in and get my lever and move it, and then put my
58 head out again. I have had no experience with the precision gear. After I have reversed the engine, if there is no other signal when I look out I follow the signal I got before I reversed the engine, but I always look out for a signal after I reverse it and before I move (T. 236–238).

F. E. Speas, a locomotive engineer employed by the Pennsylvania Railroad Company, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Paoli, Pa. I began running on the Pennsylvania in 1925 and have been in the territory between Philadelphia, Harrisburg, and Anola. We use an H–6 Consolidated type of engine weighing about 170,000 pounds on drivers, equipped with hand reverse lever; also some H–8 and H–9 Consolidated locomotives weighing between 170,000 and 200,000 pounds on drivers. The H–8's are reversed with manual levers, and the H–9's with manual screws (T. 238–240).

I was injured by operating a manual reverse lever on February 7, 1929, near Ardmore, on engine 2285, an H–6 Consolidated type weighing about 170,000 pounds on drivers. I had left Ardmore in a back-up movement to put off some cars and was moving about 8 or 10 miles an hour. I went to hook up my engine. Whether I got it latched properly or not I would not say, but the reverse lever gave a kick-back and I made a grab for it and it knocked me up against the cab. I felt something was the matter in my wrist, but thought it was only sprained. I put off a couple of cars at the next place and then went in and told them to mark me off, as I didn't know whether my hand was broken or not. The next morning the X-ray
59 showed my hand was broken. There was a little bone cracked off. The lever went back and forth through the quadrant making an arc of 3 to 4 feet, and naturally I grabbed for it. This engine had Stephenson valve motion and, I think, slide valves. I was off duty from February 7 to April 1st (T. 240–242).

I am 52 years old. I have had a little experience with the lever type of power reverse. It is a small lever about 14 inches long. It does not require very much strength to operate it. One hand will do it. I suppose it will take two or three or four seconds to place it from forward to backward motion. In the operation which I was performing at the time of my injury, that is, hooking up the engine, if my engine had been equipped with the lever type of power reverse, in my opinion, I would not have been injured. It would not have been as close to me. There is only a little short lever and I would not have been hit (T. 242–245).

CROSS-EXAMINATION

My hand was hit because I grabbed for this lever. I didn't want it flying backwards and forwards and maybe hitting me somewhere else. If the power reverse lever had been flying back and forth I would not have grabbed for it. I have never seen them fly backwards and forwards. I would not have been that close to it. This big one was flying back and forth across in front of me, whereas the power reverse lever sets up away from you more. If I had grabbed for the power lever like I grabbed for the manual bar I don't know that I would have gotten hurt. I never heard of anyone getting hurt on power reverse gears. I suppose I have

made eight or ten trips with power gear. We don't have
60 many of them on our end of the line. As to why I didn't shut off my engine, I will say it is not customary to shut off an engine every time you go to hook it up. The throttle is on the other side of the reverse lever. I might have gotten another crack and I wasn't going to take a chance of getting hit reaching over the reverse lever to reach the throttle. I was taking the safest course I could. I shut the engine off as soon as I got a chance. I had hooked it up with two hands and let go with one hand, and the reverse lever gave a kick, and of course I grabbed (T. 245–248).

RAY M. DILLER, a locomotive engineer employed by the Pennsylvania Railroad Company, was sworn and testified as follows:

DIRECT EXAMINATION

I was hired by the Pennsylvania in 1905 and promoted to engineer in 1917. My seniority district is from York to Baltimore, York to Harrisburg, York to Lancaster, and York to Frederick, Md. I have had experience in mostly all classes of service, and at the present time am engaged altogether in yard work at York. We have some B–6 six-wheel switchers weighing 184,000 pounds on drivers, some of which are hand reversed and some with Alco power reverse. We have an H–6 Consolidated type of engine weighing 170,000 to 180,000 pounds manually reversed. A few of these engines are equipped with Stephenson motion and slide valve (T. 250–252).

The clearances on some of the engines used in switching service are pretty close. They have air pipes running down along the sides, the air sander, and also the air that rings the bell. I have come in contact with those pipes when operating the lever, and I have had a knuckle knocked off, or skinned. On some engines there is no clearance between the lever and the seat box. On that type of engine I usually stand up when reversing the locomotive (T. 252).

61 In yard service in some cases I have to operate the lever every minute. In throwing over a hand reverse lever often times more strength than I have is required. Sometimes I have to move the lever with four or five hitches. A foot brace is furnished, located at about the middle of the quadrant ahead of the seat, and I use that in operating the lever. I am not able to handle the lever myself in all cases, and have to get the fireman to help me. The effect on my physical condition of operating the lever over a period of one of my regular shifts is that it plays me out. Oftentimes I have to be relieved after working only two hours, on account of an injury I sustained from the manual lever (T. 252–254).

I was injured on December 20, 1927, in York yard on engine 4003 while engaged in classifying freight cars. It was night time and dark. The throttle came open and I didn't know it. This left steam in the cylinders, and when I went to reverse the engine I

couldn't move the bar. I braced myself with my left foot against the back of the cab and forced the bar over the center. When it went over center it gave me a quick jerk, and didn't latch. The latch didn't catch, and it tore a rib loose and also the ligaments on my left side. I was off duty on account of that injury from December 20th until January 29th. I attempted to open the cylinder cocks, but the steam pressure kept them from opening (T. 254–255).

With steam in the cylinders some cylinder cocks open up pretty well and others do not. They are worked by air—it drops a pin and leaves the steam out. The valve has to lift up from the outside into the inside of the steam cylinder (T. 255).

The reasons for the hand lever operating with difficulty and for my requiring assistance with it in yard service, are on some engines the reverse bar they bind on the quadrant, because of the quadrant not being square; the engine may be out of the shop with tight boxes,
or it may be caused by not getting enough oil, or the engine
62 foaming, or a leaky dry pipe.

I have had a little experience with a smaller type engine, the R class, and from my experience I would say that the manual reverse operates about the same on it as on the larger engines. I have had a little experience on local freight with manually operated screw reverse. I had to take both hands to get the wheel around and only move it a little at a time. On another occasion I was hit with the manual-reverse bar. I was drifting down a hill and the bar caught me at the side of the hip and I was black and blue down to the left knee. I just stood there and rubbed myself. The lever went clear to the corner and I couldn't budge it. We had to stop the train to get it back. It required two of us to bring it back. The only cause I know of its going to the corner was the suction of the cylinders pulling it forward (T. 255–257).

I have had experience with Alco power reverse on B–6 engines. It takes very little strength to operate it, and I can do it with one hand. With it you can reverse the engine in from two to three seconds. I have not in my experience had any difficulty with power reverse creeping or becoming inoperative. It takes more time to reverse a hand reverse than it does a power reverse. When I have a power reverse engine I can go home feeling pretty well, but when I have a hand reverse engine I go home feeling like a man ninety years old. I am 51 years old. I can go home many times without eating anything. I have never timed myself but I know it takes twice as long to get a hard operating hand reverse over as it does the power reverse (T. 257–258).

CROSS-EXAMINATION

I have not had any experience with the power-reverse gear creeping. You can easily tell whether it creeps by the exhaust; you
63 do not watch the handle to tell whether it is creeping. When I spoke of knocking off my knuckles I meant I had skinned them. They are all right now. The foot brace extends out laterally

from about the middle of the quadrant right ahead of the drop seat. Some are fastened to the floor, others are higher. It extends out about three inches. I have not run long in road service, and have not had a power-reverse gear in that service. I have had cases of the quadrant being out of line not being put on square, or being lopsided, or high in front or low behind, causing the lever to bind. I have reported such occasions and found that the engines have been fixed later on. Another cause for a hard working lever is the valve getting dry and not enough oil. The engineer can control that from the cab with his lubricator, but the lubricator has to run for 24 and sometimes 36 hours. The lubricators are filled anywhere from 16 to 24 hours, and sometimes it runs longer than that before they are filled. We have to make a drop run from 50 seconds to one minute and have only enough oil to last anywhere from 16 to 24 hours, or a little longer. The same engine is kept running continually that long in yard service. It wouldn't do any good to report that situation. If we run out we have to ask for it. We can't run an engine without oil. You are not allowed all the oil you want. You are allowed so much for the trip. We can't get all the oil we need. If we got all the oil you needed you would be all right, but that would not always rectify the condition of dry valves because the locomotive may be just out of shop and the seat of the valves may be rough. A leaky, dry pipe will do the same thing and will wash all of the oil off the seat of the valve. I report leaky, dry pipes but they can't always fix them right away. They fix them when they go into the shop. I have an engine with a leaky, dry pipe quite often. I had one several weeks ago, and before that one a couple of months ago. I did not report these engines because I have the middle
64 trick and do not have to turn in the work reports. I am supposed to pass the word to the man who relieves me. I can't remember the last time before that that I had a leaky, dry pipe. If I would mark it down I would have it. It is not an every-day occurrence. You can tell whether you have a leaky, dry pipe by water coming out of the stack, lower water in the boiler (T. 258–268).

At the time of my injury I did not know the throttle was open until I went to reverse the engine. I had pushed the throttle shut in a hurry and it was defective at the time in that the dog was worn a little. The man who relieved me reported it, and they put on a new dog. I don't remember whether I had any trouble with this engine before the accident, and I did not get it very often after that. I shoved the throttle over in a hurry and it might have bounced open on me. The gauge light was the only light I had in the cab. I could turn on another light, but I preferred to work in the dark. The R engine I referred to weighed about 140,000 pounds on drivers. I did not have very much experience handling them but I fired a good many of them. They do not have them in service in my division any more (T. 268–270).

FRANK HURD, a locomotive engineer employed by the Erie Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I am a member of both engine service brotherhoods. I was hired on the Erie in 1905 and promoted to engineer in 1910. I run over the Marion division, Chicago to Marion, in freight service. We use a Mikado engine known as the N–1, weighing about 238,000 pounds on drivers, Baker valve gear, equipped with Precision, manual screw, and Ragonett reverse gears. We have the H–21's, a Consoli-
65 dated engine, on local freight and yard service, weighing about 178,000 pounds on drivers, equipped with manual reverse. They have some Stephenson motion engines in yard service, and some with slide valves, though most of the slide-valve engines have been scrapped (T. 271–273).

In through freight service, using the N–1 Mikado engines with manual screw reverse, if the gear is up in perfect condition it works plenty hard, but if you have a screw that is bent a little and the crosshead has to work over there, it is impossible to get it over. If your guides are too tight on the crosshead, they work hard. If your valves are a little dry, if the tumbling shaft boxes are a little tight, then it works hard. In the best of condition they work plenty hard. They have two jam nuts at the back end of the box where the shaft goes through to the wheel, and sometimes these jam nuts work up and have to be loosened with a hammer (T. 273–274).

Our water is all treated, and we sometimes have difficulty if we don't keep our engine properly blowed. If the engine gets foaming it washes off your valve and makes the engine work hard. In local freight service we have a considerable amount of switching to do. We generally do work at every station along the line. We switch across street crossings. I have had the gear stick on me and kind of throw me down in the corner, but I have been lucky I never got hurt. The H–21's are superheated engines and do not loose steam as fast as saturated engines, and lots of times you want to make a move before your engine has released all of the steam, and you grab your lever while you still have steam in the cylinder because of the superheater. You are not able at all times to release the steam from the cylinders. Sometimes the cylinder cocks will stick, and you can't kick them off, because of pressure in the cylinder. In switching over road crossings and in cities you can't use your cylinder
66 cocks on account of blowing water or steam on the traveling public or someone around the engine (T. 274–276).

With our manual screw it takes 21 turns of the wheel to reverse the engine. That interferes with your lookout duties, because in a back-up movement you have to get your signal and then come in and make your move with the wheel, and you don't want to make too many moves on account of the brakeman giving a missed signal.

You want to get all of them while he is giving them to you (T. 276–277).

On our H–21 Consolidated engines, weighing about 176,000 pounds on drivers, the manual lever works easy on some of them and hard on others. Most of them are very hard to handle, if they are not properly oiled or alemited. Blown valve, the engine new out of shop, tumbling shaft boxes up snug, binding on the quadrant, dogs too tight in latch, or a tight latch spring will cause the gears to handle hard. Our counterbalance springs are kept up in first-class condition (T. 277–278).

I was injured in the operation of a manual screw gear on January 17, 1929, at Pieffer, Ohio, on engine no. 3033, an N–1 Mikado, weighing about 238,000 pounds on drivers. We were in a back-up movement, and I was sitting sidewise on my seat box so I could look out of the window backing up. I had my hand on the reverse-gear wheel. The reversing wheel and gears went up and we went out. We went out of the cab on account of the hot steam. The bracket studs on the boiler had pulled out, throwing the reversing gear up towards the top of the cab. The bracket studs are fastened on the side of the boiler, holding the reverse gear guides and cross head where the wheel fits on. I believe the place is about 15 inches long and 14 inches high with four studs at the bottom and three at the top, the studs being about seven-eighths of an inch in diameter. These studs go clear through into the boiler. Mr. McKeown (the district inspector of the Bureau of Locomotive Inspection) told
67 me that two of the studs had pulled out of the boiler, two of them were broken off, and one was 75% cracked and the other was 25% bent. The steam escaped out of the stud holes in the boiler. The fireman, brakeman, and myself left the engine. I jumped out of left cab window. The fireman and brakeman tried to get out the front door of the cab. The brakeman was fast there, but the fireman followed me out through the left cab window. The brakeman finally tore his coat off and got out. I was scalded about the face and hurt my back as I fell 12 to 14 feet to the east-bound track. I was off duty about 15 days. The fireman's hand was scalded and he was scalded badly about the face. He was off duty for about four weeks. The brakeman was scalded badly about the face and was off about five weeks. The company paid me $180.00, the amount of my time and the hospital bill (T. 278–282).

I have had experience with manual lever, manual screw, and precision power reverse. Our engines are now about half of them equipped with the precision gear, and as fast as they go into the shop they come out equipped with them. There is no comparison in the relative amount of strength required to operate the hand operated screw and the power screw. You have air to help you with one, and the other you have to use all manual strength. I have had no trouble whatever operating the precision power reverse. I do not think if we had had the precision screw any one of us would have been hurt on the occasion I described, because it would have

torn off outside where the air cylinder is connected to the reach rod. With the manual screw the reach rod is run from the valve motion clear through the cab, but with the precision gear the reach rod runs from the cab only to the air cylinder (T. 282–283).

CROSS EXAMINATION

The precision gear is fastened to a bracket on the boiler
68 but the studs do not go clear through the boiler. The bracket is fastened from underneath somewhere. I don't know whether the practice of the company today is to put the studs through into the boiler on manual screw engines or not. We would not have had that particular type of accident with the manual bar. I noticed that the bracket on my engine was working on the studs when we left the yard, but I did not observe it was getting any worse. I did not report it because I did not notice it at the time when I was in the yard (T. 283–286).

On our N–1 Mikado engines they are taking off the manual screw reverse as fast as the locomotives go into shop, and they are coming out equipped with precision screw reverse. As fast as the H–21 engines, which are equipped with manual levers, go in the shop I understand they are scrapping them (T. 287).

Mr. Thom, Jr., on behalf of the defendants, stipulated with regard to the accident reports found in the office of the Bureau of Locomotive Inspection, that if offered as exhibits defendants will not object to copies of said reports because they are copies, reserving all other rights to object as to their relevancy. It was stipulated by Mr. Thom that the defendants would not require the presence of the inspector making the report as a medium of introducing the accident reports (T. 289–291).

MATTHIAS GINDER, a locomotive engineer employed by the Erie Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I am 53 years old and have been with the Erie since 1897. My first experience was in the shop. I went braking in 1899 and in engine service in 1901, being promoted to engineer in 1909. My seniority district is from Kent to Marion, Ohio, and from Marion to
69 Dayton, Ohio. I have had experience in all classes of service. In freight service we use a Mohawk type of locomotive weighing from 276,000 to 286,500 pounds on drivers, equipped with precision type of power reverse. Occasionally we get an N–1 Mikado type of locomotive weighing from 238,000 to 240,000 pounds on drivers, some of which are equipped with Ragonett power reverse, and others with manual screw. In work-train service we get an H–21 Consolidated engine weighing 176,000 to 187,000 pounds on drivers, equipped with hand lever. In passenger service we have a K–1, 2–6–2

type weighing about 154,000 pounds on drivers with manual lever, also a K–4 and K–4–B, 4–6–2 type weighing from 186,000 pounds to 188,000 pounds on drivers, equipped with power reverse. The H–21's and K–1's have Stephenson motion, and the H–21's have slide valves (T. 291–295).

I have worked regularly with the H–21 engines weighing about 176,000 pounds with hand lever reverse, and will say that at times it will work hard and other times not, according to the condition of your valve and motion work. The engine working water will cause the lever to work hard. We use treated water. I think the chemicals make it foam at times, especially when you run them a while and it accumulates in the boiler, and I think it makes them foam worse, although they blow out our engines well nowadays. There are about 17 bearings on this type of engine. Sometimes they get dry and they are worn, making them work harder, especially if you have steam in the cylinder.

There are many times when you have steam in the cylinders and can't kick open the cylinder cocks, especially when you are switching over crossings or there are switchmen or anyone working alongside the engine. All the engines are equipped with foot braces which I use to brace myself when reversing them (T. 295–297).

I have run a K–1 engine once in a while in extra passenger
70 service. I think we have only one of them on our division any more. There isn't much difference in the lever except if you want to reverse the engine in back motion you would have to get behind the lever and run outside the cab alongside the back of the cab. Some of them, with which I have had most of my experience, have a double quadrant with notches on each side and the lever in between (T. 297).

When I first went on the road I had experience with a modified O type, a 2–6–0 engine, weighing about 90,000 or 100,000 pounds on drivers. There was not very much difference in the handling of those engines with the larger engines I have described (T. 298).

I was injured by operating a manual screw reverse on May 6, 1928, on a work train between Canton and Barberton, engine no. 3064, an N–1 Mikado with Baker valve gear, weighing 238,000 pounds on drivers. It had come from the shop after class 4 repairs. I told them it was not fit to take out and they said it was the only engine they had and I should take it. You could hardly reverse it. When we were at work, the supervisor bawled me out for not handling it right. At noon I called him on the engine and he couldn't budge the wheel. The fireman handled her; I couldn't handle her any more. I couldn't get off my feet after awhile. I had strained my hip reversing it. It had worked so hard. It had just come from shop and everything was new. I was off duty from May 7 until August 16. The company paid me for lost time (T. 298–300).

I have had power-reversed engines new out of the shop, and have not had any similar difficulty in reversing them. I have never been

unable to reverse an engine equipped with power reverse. I have had experience with Ragonett and precision gears (T. 300–301).

In my opinion power reverse is a lot safer than hand reverse, because they are not as hard to handle and there is not as much danger in getting hurt from them (T. 301).

71 CROSS EXAMINATION

As to the modified O engines weighing between 90,000 and 100,000 pounds of which I spoke, I fired them when I first came to the road and handled them for the engineer at times when I was running the engine in his place. I have had them on work-train service since I went running a few times. I don't believe they have had many of them around for 15 years. I did not throw over the lever for the engineer when he was running the engine, and I do not remember of his calling on me to come over and help him throw it (T. 301–303).

With reference to the time when I sprained my hip there was no contributing cause to my laying off. The rather severe strain kept me off from May 7 until sometime in August. I couldn't walk. The sprain was due to pulling hard on the wheel that you reverse the engine with. You couldn't turn the wheel without jerking it. You jerked it a notch or two at a time it worked so hard. I had my feet on the floor and used all of the strength I could pull with. I never had a power reverse engine that was as tight as that particular hand gear (T. 304).

When I first started running the reverse gears were mostly manually operated—the lever type. In 1911 or 1912 we got the N–1's equipped with Ragonett power reverse, which were the first with air reverse. Until the N–1's came I do not remember any wheel reverse. Gradually since the N–1's came to the present time they have been putting on more power reverse (T. 304–305).

As to the 17 or more bearings in the valve gear and reverse gear which tend to make manual reverse work harder, there are many times when you can and other times when you cannot oil them. If you are in a hurry you cannot get around to examine all the oil holes.

72 Again, the motion work of the Stephenson valve gear is under the engine and you can't crawl under the engine and clean them out. I believe we have a few Stephenson engines on our division yet (T. 305–306).

The foaming of the water we are able to control pretty well if we have enough water to do it, but we work our engines so hard sometimes we do not have water to blow them. If the water is bad you can't carry any water to blow them out. We have certain places to blow the engines, and blow them whenever we get a chance. They run our engines through, and we have different kinds of water and take water at different places, and that has a tendency to make it worse. Sometimes we make regular stops for water, and sometimes you go right from one division to another, depending upon the kind of a train you have (T. 306).

We have the alemite system, which works automatically, except that we have to oil the guide by hand. For lubricating the steam valves we have hydrostatic lubricators, which have feed glasses, which you observe in the cab. You regulate this lubricator so as to keep your valves properly lubricated, so that when you discover by the use of the lever that it is beginning to work harder than ordinarily, unless there is something to prevent you at the particular time, you adjust the lubricator to let a little more oil in. I have used hydrostatic lubricators since I first began running (T. 307–308).

Some of our engines have force-feed lubricators which sit back of the steam chest and force the oil into the cylinders and valves, there being pipes from the lubricator which forces the oil in as the engine moves. There is no indicating or regulating device in the cab. It works mechanically and without attention. With the power gear, if anything went wrong with the force-feed lubricator you would know it by the squealing of the valves when they get dry, and by the exhaust. It would make the engine lame. You can also tell by the way the train handles. It slows up and
73 doesn't have the power when the valves are dry that it does when they are lubricated. That experience takes place after the valve becomes dry, but when it starts to get dry you can tell, because the cylinders groan and squeal. The cylinders do not get dry until after the valves get dry, because lubrication comes to the valves first. This is not true with the force feed because you have a pipe to your cylinder and a separate pipe to your valve, but with the hydrostatic feed it would be true that the valve would get dry first. With the power gear it would be some little time after your valve started to get sticky until your cylinder would get dry, and you would be able to notice it in the pulling action of the locomotive. Dry valves manifest themselves on the hand lever by causing it to jerk and rattle. When this begins to happen that is when the hand lever jumps out of the quadrant. I do not recall ever having one jump out. I always run with a railroad spike placed into the notch of the quadrant ahead of the lever. That is, not in switching service, but on the road. When we get the engine hooked up we put the spike down about where we want the lever so that if it gets away the spike will catch it. It acts as sort of a block (T. 308–312).

I have had the manual lever get away from me many times and have had it go down into the corner. We were instructed always to drop our engines to half stroke running down a hill, and when we start up another hill we put it back into short cut-off, and a lot of times it will get away from you. The lever will jerk out of your hand and go toward the front. The steam is shut off. We shut it off at the top of the hill and do not pull it open after you have the engine hooked up. I have never tried opening my throttle slightly before hooking it up under those circumstances. We never use steam on a slide valve down hill. I have used piston-valve engines a few times and have run them enough to know that they handle about

the same as the slide-valve engines I have spoken of. These
74 piston valve engines originally were equipped with slide valves, but they put them through the shop and gave them a piston valve, as I remember it. The slide valves of which I spoke were called balanced valves and have balance strips which break at times and make the engine handle harder. When the valve is in normal condition those with the strips in place it equalizes the steam pressure on both sides of the valve and the purpose is to make it slide more easily (T. 312–314).

I have been an engineer 22 years and have run power reverse about 18 of the 22 years (T. 314–315).

REDIRECT EXAMINATION

If the engine is foaming the mere increase in the amount of lubrication will not remedy the trouble right away. It takes a long time to lubricate an engine after it becomes dry. If the water foams and gets into the cylinders you cannot get them lubricated. It washes the oil off as fast as it goes in (T. 315).

When the valves become dry on a power reverse engine you can't tell it by the lever in the cab. On the precision gears once in a while, if there is lost motion, they will work a little harder. There is nothing about the action of the power reverse lever with dry valves which might injure me. You can tell that a power reverse engine is running with a dry valve because they get lame, the same as another engine. The valves will commence to squeal and the cylinders groan. You cannot tell that it is getting dry as quickly as a manually reversed engine because you do not get hold of the lever, and can't tell it by the lever (T. 315–316).

I haven't had any of the hand reverse engines recently and couldn't tell you how many times I have experienced foaming to such an extent that it made the valves dry on them (T. 317–318).

75 W. T. LAWRENCE, a locomotive engineer employed by the Erie Railroad, was sworn and testified as follows:

I live at Hornell, N.Y., and am 71 years old. I have been with the Erie since 1891, having been promoted to engineer in 1902. My territory lies between Hornell, N.Y., and Salamanca, N.Y. I have had experience in all classes of service, although very little in yard service. I have had considerable experience in local freight service where I had switching to perform. At the present time I am in through freight service, using the Mohawk type locomotive, weighing about 276,000 pounds on drivers. I have used the same classes of engines that witness Ginder described. I have had considerable experience with the H–21 consolidated engines, weighing about 176,000 pounds on drivers equipped with manual bar, and the Atlantic K–1 type engine weighing about 154,000 pounds on drivers equipped with the manual bar. Sometimes it was almost impossible to reverse these H–21's in freight service, especially if the engine had

recently come from shop and the connections were tight. Often I have had to call for help from the fireman (T. 319–321).

On those engines the forward end of the quadrant extends nearly to the injector pipe. There is no block at the end of the quadrant and if the lever goes the extreme length you are apt to strike your hand. We aim to put a block at the end of the quadrant to save ourselves. At the back there is just about clearance for our hand to pass the back board. I have repeatedly struck my hand on these places (T. 321).

I have very often had the lever jump out of the quadrant on these types of engines. On the K–1 engines, and I think we only have one at the present time, we had a double quadrant, the lever working in between two quadrants, the notching of which was very fine. If you happened to drop a little oil on the quadrant, which would often happen, the lever would let go and go to the corner. We used
76 to get blocks of wood or wedges and when we had the lever hooked up we dropped in the block, so it couldn't go ahead, otherwise you had to sit and hold the lever all the time. Often I would hook up the engine and before I could get the block down, or if I had to leave it a few seconds, the lever would go to the corner, and it would take about all the strength I had, and sometimes I had the fireman assist me, to bring it back. I should say there was danger in the lever going to the corner under those circumstances. The causes of the lever jumping out of the quadrant, in my experience, are: a defect in the latch or quadrant, dry valves, tight connections in the motion work, but the great difficulty would be a weak latch spring, so that if the engine strikes a low point it would jar the latch out. Improper counterbalance has a lot to do with it. If the latch in the quadrant were in first-class condition, I do not know whether the fact that you have dry valves would cause the latch to jump out. Whenever I had any experience outside of the engine of which I have been speaking where I placed blocks in the quadrant to hold the lever, it was caused by vibration working the latch up and out, even though they were in fairly good condition. The vibrations from the lost motion would gradually draw the latch up until it would go. If you would strike a low point it would go down, otherwise not. The counterbalance pulling on it if it wasn't just right would also have a tendency to work the latch up. Keeping the quadrant and latch in proper condition would correct this trouble to a certain extent and would be a great help. I cannot say as to just what extent it would eliminate the trouble, but it would eliminate considerable of it (T. 321–325).

When I first commenced firing the power on our road was much lighter than a few years later. I fired a 2–4–0 engine and reversed it for the engineer who was an old man. At times it reversed
77 very hard, even though it was a small engine. There were no obstructions around the lever, except it came in close contact with the brake valve. I never knew of anyone being injured on

those engines. Later we got the class O engines weighing about 80,000 or 100,000 pounds on drivers. They handle about the same as the smaller ones I have just described and the H–21 Consolidated engines which are much larger (T. 325–328).

I was injured by operating a manual lever on May 5, 1927, on engine no. 2029, an H–21 weighing about 176,000 pounds on drivers. We were about 7 miles out of Hornell, N.Y. The engine had come from the Meadville shop and they coupled it ahead of my train. When I unlatched the lever at a place where we were taking water it went down to the corner. I went under the engine and attempted to loosen the counterbalance nut with a wrench, but the nuts were rusted so I could not start them, nor could I move them with a hammer and set. The other engineer tried to help me but we could not start them even with the hammer and big wrench. The only thing we could do was to go ahead. The next time I dropped the lever I managed to get it back where I wanted it without assistance. After running down a grade I started to hook the lever up, and as I unlatched it it went down 4 or 5 notches in spite of all I could do. I called to the fireman to help me. There is plenty of space and I stepped around in front and took hold of the lever. The fireman took hold, using the foot rest at the front of the quadrant, and we pulled the lever back. When wet got it back where we wanted it the latch stuck and would not come down. We kept trying to work at it, and as it worked down it pushed me back and I caught my elbow between the lever and the injector pipe, enough to catch it. Something gave way in my wrist, and when it did I threw up my arm and the lever got away from me, striking me on the wrist. One bone was broken and the other was slivered and bent up. When the lever dropped down it went back and forth and back and forth, I
78 don't know how many times, and finally came up and caught nearly half way up. I was off duty from May 5th to August 25th, 111 days (T. 328–332).

I have had power reverse engines that were new from the shop but I had no difficulty whatever in reversing them. In my judgment, if the locomotive on which my accident occurred had been equipped with power reverse, the lever never would have unlatched. The company paid me between $400 and $500, together with the doctor and hospital bills (T. 332–333).

CROSS-EXAMINATION

When I spoke of the K–1 engine with a double quadrant having small notches on which the latch was inclined to work out, I was speaking about one particular engine with which I had more experience. All the engines were equipped the same. I never had the trouble on the others in the small experience I had with them. I think this was in 1917 or 1918. We have only one engine of that type at the present time, and the others, I understand, went into commuter service at Port Jervis. I couldn't say whether they have

that quadrant arrangement at the present time or not. These notches were smaller and not so deep, and the dog, instead of being put in one latch, had a series of notches, three or four, which were meshed together. In the ordinary type of quadrant the notches are about a half inch deep. The latch is the width of the quadrant and is supposed to go in to the depth of the notch. With the exception of this one class of engine, the others I have used have been of the ordinary type of latch and quadrant as last described, that is, with the exception of a few screw levers. I would not say from my experience that the ordinary type of Johnson bar latch and quadrant held the bar wherever I put it so long as I did not raise the latch.

I have run engines when the latch and quadrant were in what
79 we would term " fairly good " condition when it was necessary to use something else to hold the latch in place. I cannot recall any particular instance, but I have run regular engines on which I always carried a bull ring, which is a ring made to drop down over the end of the reverse lever above the latch, and lock the latch so it couldn't get away, because they would sometimes let go, and for safety for ourselves we carried those. This applies to our H–21 engines, which are the only engines I ever run with a manual bar, and I ran those regularly for a long time in freight service. The handle that manipulates the latch sticks out diagonally near the top of the manual bar, and we would drop this ring over the handle of the bar down to the latch handle, and that would hold it so it couldn't pull the latch up. We found it would stay where we put it then. The same result could have been accomplished by a stiffer type of spring. The loose vibration on the engine would naturally work the dog up, whereas with a stiffer spring it would be held in place or would be more apt to be so held (T. 333–341).

" By Mr. MOREHOUSE:

" Q. Now, Mr. Lawrence, aside from that experience and that method of which you spoke, using that ring to take the place of a stiffer spring or compensate for a weak spring, we might say, with that exception, hasn't it been your experience that the Johnson bar type of lever will stay in the quadrant wherever you put it, assuming that the dog and the notches in the quadrant are in proper condition and not unduly worn?

" The WITNESS. Can that question be answered without the ring, without using the ring? That is the way I understand it.

" Examiner ROGERS. Will you read the question again, please, Mr. Reporter?

" (The question was then again read by the reporter, as above recorded.)

80 " The WITNESS. Well, they should do that anyway.

" By Examiner ROGERS:

" Q. The question is do they?

" A. How is that?

" Q. The question is, Do they stay in?

"A. Well, I have had cases when they were supposed to be in good condition and all that where they have still, due to some low joint on the track, perhaps, and the creeping up and getting part way out of the notch, they would jar up and go down.

"By Mr. MOREHOUSE:

"Q. Mr. Lawrence, with a spring with the proper degree of tension and pressure on top of the latch or dog it would not creep out or could not creep out, could it?

"A. Oh, yes. If they had a spring stiff enough to hold that down so that it could not get out it naturally would not get out. But with a spring of that kind it would be pretty hard to operate and operate your lever at the same time, because it would take nearly the strength of one arm to hold that spring, with enough tension down at all times—to hold that spring while you were operating the lever, because that spring would be dragging down, and every time you didn't have that up every notch she would come to she would drop in.

"Q. Is it your idea that the ordinary type of spring used on those levers is not stiff enough?

"A. Well, I wouldn't say as to that. It was the type that was furnished by the company and we have been compelled to use them. That is all I can say."

I have had only three occasions to use the manual bar since 1925. The trip on which I was injured was one of these occasions. I think the mechanical department is as good as on the Erie Railroad as on the average road. I have no fault to find. The thing that
81 caused the gear to operate so hard on the day I was injured was the way the counterbalance spring was adjusted against the extreme tightness of the locomotive coming out of the shop. The counterbalance spring had not been adjusted up to a higher tension to take care of the tightness of the valve gear parts and to balance the weight of the reverse bar. Prior to 1925, with the exception of seven or eight months, I operated hand levers exclusively (T. 341–349).

It was stipulated by Mr. Thom, Jr., on behalf of the defendants, that defendants would not object to the introduction of the accident reports in the files of the Bureau of Locomotive Inspection because they were copies of the originals, and that defendants are willing to extend this stipulation to such accident reports in respect of engineers who were not called as witnesses. This stipulation is made with the express understanding that the defendants reserve the right to object on proper grounds to any of these other accident reports, and with the understanding that if defendants desire to present accident reports of the same character and from the same Bureau counsel will also stipulate that they may do so. This stipulation was agreed to by Mr. McLaughlin on behalf of the complainants (T. 350).

LINCOLN G. TANNER, a locomotive engineer employed by the Boston & Maine Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Melrose, Mass. I was employed by the Boston & Maine as a fireman in 1904 and promoted to engineer in 1918. My seniority district extends from Boston to Portland, Portland to Worcester, Boston to Intervale Junction. I have had experience in all classes of service, and at the present time am firing a local passenger train, having done my last running about six months ago in pas-
82 senger service. In passenger service we use a Pacific type of engine weighing 170,000 to 200,000 pounds on drivers, some of which are hand reversed and others power reversed. We also have an Atlantic type weighing about 140,000 pounds on drivers, which are mostly hand reversed, and Mogul engines weighing 100,000 to 140,000 pounds on drivers, hand reversed; also an eight-wheel class weighing 80,000 to 100,000 pounds on drivers, manually reversed. I have had experience on all of these classes of engines. As to freight engines we use the Mogul type and also a Consolidated type weighing 170,000 to 200,000 pounds on drivers, all hand reversed. We have heavier engines from 200,000 to 250,000 pounds on drivers, and Lima engines from 250,000 to 300,000 pounds on drivers, both of which classes are power reversed, using Alco and Franklin precision gears. As to switch engines we have some six-wheel engines weighing 80,000 to 100,000 pounds on drivers, some of which are hand and others power reversed. Some of them have slide valves and others piston valves, the latter having Baker valve gear. We also have some six-wheel switch engines weighing from 200,000 to 250,000 pounds on drivers, equipped with power reverse (T. 351–355).

On the Atlantic type of engine the lever extends about three and a half feet above the floor board, or about three feet above the quadrant, and makes a sweep of 4½ to 5 feet in going from forward to backward motion. Clearance is very close at the back side of the cab. You have to stand up in order to pull the lever back into full reverse, and the lever goes part way out of the gangway. If the lever is in back motion, you can throw it in forward gear by turning around and unlatching it forward without getting off your seat box. In order to put it in full back motion you have to get up off your seat and cross over the quadrant. There is danger in that operation because with the engine moving it might fly out of the quadrant and catch you. We have several local trains that run backing
83 up and you would naturally hook the lever up in backing up the same as in going ahead (T. 355–357).

It is very hard to hook up some of the engines of our Pacific type. Some of them have a foot brace, but others do not. The reverse lever is directly in front of the seat box on some of them. On these

engines I usually place my foot against the side of the cab window, or on the piping or brake valve to keep the lever from jumping out of my hands and going to the corner. I have had the lever jump out of the quadrant on these engines very often. That is caused by fittings in the valve gear being tight, dry valves caused from poor lubrication, tight valve rings, and sometimes an engine working water. Engines just out of the shop where all bearings are tight often cause it, and also uneven places in the road bed. Engines with steam in the cylinders reverse quite hard on account of having to lift the link motion and valve gear. In switching service it is quite difficult to reverse the engine with steam in the cylinders, especially on the 400 class equipped with Baker valve gear, where the levers handle extremely hard. It is necessary for the engineer to stand up, usually standing in the window to operate those engines. I have often required assistance in reversing them (T. 357–359).

The smaller engines, weighing around 100,000 pounds on drivers, have slide valves and Stephenson motion, whereas on the larger power Walscheart motion and piston valve are used. I consider these smaller engines practically as hard as the other to handle (T. 359).

I was injured by a manual reverse lever on December 4, 1928, while running an extra passenger train from Rockport to Boston. The engine number was 3611, a Pacific type locomotive weighing 170,000 to 200,000 pounds, equipped with a hand reverse lever. On this engine the lever stands directly beside the engineer right
84 beside the seat box. It is a very long lever extending about even with the man's shoulder. After leaving Lynn I noticed the engine began to kick on the lever as if it was not getting proper lubrication. In order to reach the lubricator I had to reach over in front of the reverse lever. I was going 45 to 50 miles an hour. I stepped up to reach over and increase the flow of oil in the lubricator, and as I did so I heard a click in the latch of the reverse lever, jumping out two or three inches. I jumped to save myself, and in so doing, because of the motion of the engine, I struck my heels against the seat box, which threw me sidewise and threw my shoulders out of the window, and I threw my left leg up a little in doing it. When the lever clicked it jumped again. It all happened in an instant. The next time the lever went into the corner, catching my leg across the calf of the leg, breaking a small bone in the back of my leg and a large bone, splitting it up lengthwise from the ankle joint about eight inches, cutting into the muscles in the calf of my leg. I immediately applied the brakes and stopped the train. The fireman came over and pulled the lever off of my leg, releasing it. It sort of numbed it at first. I called in the flag. I knew there was no relief there for me, and I started for Boston. I ran the train into Boston. As I slowed down going into the station I told the fireman to drop off at the yardmaster's office and inform them to send a crew out to relieve me, which he did. The

assistant superintendent of the terminal and the trainmaster came down, and they got an ambulance and took me to the Massachusetts General Hospital. I was in the hospital 16 days and off duty six months. The company paid me about $563.00, together with my hospital and doctor bills (T. 359–362).

Our six-wheel switchers with Baker valve gear, weighing 140,000 pounds to 170,000 pounds, are some of them equipped with
85 power reverse and others with manual reverse. There is a great deal of difference in reversing these two types of gears. When I got through with running these manually reversed locomotives eight hours my arms and shoulders were pretty lame. When they first got these engines they often had to call an extra man to assist the engineer in reversing them. I had no difficulty whatever in reversing those which were equipped with power reverse. I can reverse the power reverse engines with one finger and thumb. It takes just a couple of seconds. I refer to the Alco gear (T. 362–363).

CROSS-EXAMINATION

I have never made a stop watch test of how long it takes to reverse the Alco gear. Two seconds was my judgment of the time as nearly as I could judge it. It wouldn't take four or five seconds. The 400-class switcher with Baker valve gear was the type of which I spoke where an extra man was needed to help handle the reverse lever. We have had these engines from 10 to 12 years. The second man was called from time to time as the engine worked hard, and while the engines were new and being broken in (T. 363–365).

With reference to the type of engine where the reverse lever went out into the gangway two or three inches when placed in extreme back motion, the company had to cut a piece out of the back board of the cab to give room to pull the lever in full reverse, and clear your hands. It was so cut out that you have plenty of clearance to get your hand back to get the lever. You would have to get off your seat and cross over the quadrant in order to pull it into full reverse without striking your elbows against the side of the cab. I always got off my seat to pull it back. All of those engines came back in reverse very hard. I would pull it from the forward corner clear to the back corner from the deck of the locomotive. There would be no occasion for doing that except when the locomotive was
86 standing still. There wouldn't be any danger in the lever flying out of the quadrant and hitting me while the locomotive was standing still. When I answered before that it was a dangerous procedure to cross over the quadrant in that way I understood the question to relate to cases when the engine was in motion. We would have occasion to cross over the quadrant if the engine was in motion. We have several trains using these engines where we back up, and with the engine in back-up motion it is necessary to cross the quadrant to hook up the lever as you do in going ahead. After you get it hooked up a few notches you can hook it up the rest of the way

from your regular position in the cab. This Atlantic type of engine is the only type on our line which has the lever extending back so far in the rear. This type of engine is still in service. My injury was not on this type of engine (T. 365–371).

At the time of my accident I had noticed by the lever that the valve was getting dry, and I reached over to adjust the lubricator to feed it more oil. It was while I was doing this that I heard the click, and in hurrying to place myself in a new position after that, I unintentionally allowed my leg to get over in front of the lever. In order to reach the lubricator I had to step up on to the quadrant. That is because the lubricator is so high I cannot reach it from the foot board. Most of the lubricators on other engines are at the top of the cab. Some are on the left side of the cab. On some of our engines the lubricator can be reached by standing on the foot board, and on others of them they cannot. If this particular engine had a lubricator that I could reach by standing on the running board or from my position on the seat, then I would not have been hurt because I would not have been stepping across in front of it (T. 371–372).

87 Oftentimes there will be a vibration and a yank on the manual lever which indicates dryness in the valve. It does this quite promptly. I have an oil can and whenever I have an opportunity I oil the locomotive on the trip if it needs it. I look over the valve gear to see whether it needs oiling. The lubrication of the valve itself I can control with the lubricator in the cab. With the latch and quadrant in proper condition under ordinary conditions I have seen them fly out of the quadrant. This happens quite often on our Pacific engines in through passenger service at high speed, the cause of it being vibration and rough track. The latch spring might be weak, and also lack of lubrication. If there is anything mechanically wrong I report it in my work report, such as a weak spring, and I have reported them because the latch and quadrant had become worn. Sometimes I have had them fly out from vibration and high speed caused perhaps by the bearings or the pins being worn a little. When the engine gets worn more or less it takes but very little slack when it is running 60 or 70 miles an hour to throw out the lever. To counteract that I would run with a monkey wrench between the latch and lever in order to hold it. I have also held it there mile after mile with my hand. I would just rest my hand or the weight of my arm on the reverse lever latch at the top of the reverse lever. I found that that usually controlled the latch so that it would not jump out. I also would screw the money wrench on the reverse lever so as to keep the latch handle from coming back toward the lever. A stiff spring to hold the latch in the quadrant would perform the same purpose. I have been running engines probably nine years all told. I do not know what the proportion of that time was with manual reverse but I judge about 75% of it (T. 372–378).

I have operated 80,000-pound manually reversed engines equipped with slide valves. I consider them just as dangerous as the heaviest type and some of them were as hard to operate (T. 378).

88 REDIRECT EXAMINATION

On the occasion when I was injured I observed nothing about the condition of the quadrant and latch except as the engine began to kick on the lever. When I would hold my hand on the latch to hold the lever in the quadrant, if the lever got away from me I should let it go. I should not undertake to stop it. There would be no likelihood of injuring my hand, but I should let it go. If I had a spring stiff enough to hold the lever in the quadrant it would be very difficult to unlatch it with our present arrangement (T. 378–380).

RECROSS-EXAMINATION

As to whether there is any reason why a different arrangement of some kind should not be used to give more leverage so you could raise a stiffer latch spring, I don't know what arrangement that would be. I have seen some men put a piece of pipe on the latch while shifting cars in the yard to unlatch the lever. That is the only device I have ever seen used. As to whether from a mechanical point of view there is any reason why the handle of the latch could not be made with a longer projector, or, in other words, a longer fulcrum, so as to give more leverage from the same pressure of your finger, they could make the handle of the latch longer if they wanted to, and they could make it two feet long, but the latch would be rather awkward to handle. I am forty-nine years old (T. 380–381).

JAMES BROWN, a locomotive engineer employed by the New York Central Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I reside at Oswego, New York, and went into engine service on the New York Central as a fireman in 1893, and was promoted to engineer in 1903. I work on the Ontario and St. Lawrence
89 Divisions, and have had experience in all classes of service.

At the present time I am in transfer service at Oswego, using a *six-wheel power reversed* engine weighing 170,000 pounds on drivers. We have no other engines used regularly in transfer service. In freight service we have an F–2, a 4–6–0 engine weighing 170,000 pounds on drivers reversed with manual bar, and some 4–6–2 engines weighing 170,000 to 200,000 pounds on drivers, some of which are manually reversed and others power reversed. In passenger service we use the F–2's and also a 4–4–2 engine weighing 170,000 to 200,000 pounds on drivers, some of which are manually reversed and others power reversed. In passenger service we use the F–2's and also a 4–4–2 engine weighing from 80,000 to 120,000 pounds on drivers, all manually reversed. They also use some of the 4–6–2 engines I previously described in passenger service, but I have not used any of these. I have had experience with all of the

other engines I mentioned. None of these engines have slide valves (T. 382–384).

On the 4–4–2 engines, which I have described, the reverse lever is pretty close to the boiler head in forward motion, and to the back end of the cab in back motion. I have skinned my knuckles lots of times. Both ends of the quadrant are equipped with a stop pin. On the 4–6–2 engine, clearance is just the same (T. 384–385).

The manual reverse engines handle hard if valves are dry or the rings worn or when they are right out of the shop. The management is pretty good about doing what it can to make them handle well and remedy this. With engines out of the shop we have to have the fireman help us in reversing the lever. In picking up or setting out cars in local freight service, if you get a hard engine to handle, you are pretty tired after working twelve to thirteen hours and the fireman is also tired from helping you. We get along the best we can (T. 385–386).

I have had experience on the E–1–A class, 2–6–0, engines
90 used in local freight service which weighed between 80,000 and 100,000 pounds on drivers. As to how the reversing of those engines compares with the larger type of manual reversed engines, they all handle hard enough, but there is always the danger of getting your fingers or feet caught, and you have to look out for the danger of getting hurt on them. These small 2–6–0 engines have now all been scrapped (T. 386).

I was injured by operating a manual-reverse lever on September 24, 1929, between Lacona and Richland, N.Y., on engine no. 2102, a 4–6–2 type of locomotive, weighing about 186,000 pounds on drivers. I took the engine en route. We had only about five minutes in Watertown to cut the engine off of the train, change crews, get water, couple on to the train, try the brake, and leave on time. We generally got out about two or three minutes late, and I did the best I could to leave on time. I didn't have much time to inspect the engine or oil around. Going into Lacona I remarked to the fireman that the lubricator was dry. The lever was checking pretty hard. He asked me to see how it stood, and said that we would fill it in Richland. That was about five miles from Richland, where we could fill the lubricator. We had a little extra oil on the locomotive. After shutting off at Lacona and going into Richland I pulled the lever off the center of the quadrant to look at the lubricator, and in so doing I pulled the lever a little past the center. I was running about 45 miles an hour. I looked over the lubricator and got back to take hold of the reverse lever to pull it where it belonged, and it went into the corner with me and broke my forearm; broke both bones. When the lever got loose it took me on with it right up against the boiler head. My arm laid right against the drip pipe from the right water column and the feed pipe to the bell ringer and sander, which pipes are about six or eight inches apart. I was unable to get my arm out from under the lever myself. The fireman tried to get the brake valve to stop the train, but couldn't because

I was in front of the brake valve and down low. He grabbed
91 hold of the reverse lever below my arm, and, he being a pretty strong fellow, we unlatched it with the left arm and pulled it up enough so that I lifted my arm out. I was unable to take the train in, and the fireman took it in and stopped at the depot. They took an X-ray and discovered that both bones in the forearm were broken and the ligaments bruised. Some doctors wanted me to amputate the arm, but the company doctor said he would save it, and he set it the next day and did a pretty good job of it. I still have the arm. I was in the hospital about six weeks and off duty about five months. My claim for lost time is still pending before the company. I have no effects of that accident at the present time that I know of. I am just as good as I ever was, except the inconvenience, when eating with a spoon or something like that, when it is a little difficult. I am just as good as I ever was, and I am just as strong. I think the injured arm is a little shorter than the other (T. 386–390).

At the present time I am operating power-reversed engines practically all of the time. I have never had any difficulty in reversing an engine with power reverse. I have had the power gear creep, but just for one trip, and after I reported it it was fixed. It was due to packing in the cylinder. I did not see any dangerous condition during the time the power reverse was creeping. As soon as you notice this creeping all you have to do is to shift your lever, and that brings the valve motion back where it belongs. It doesn't bother me to work all day with the power-reverse gear. I would be pretty tired if I had a hand reverse. You can do your work much more quickly with power reverse than with hand reverse, and we have pretty hard drags from one yard to another, where just as soon as you get under speed you can hook them up. With power reverse you can hook the engine up with one hand, whereas if you had a hand reverse, with the crossings you have to go over, you would have to leave the engine in the corner and burn a lot of coal.
92 You wouldn't have time to move the reverse lever. With power reverse you can keep your eye on the gun every minute and use the other hand (T. 390–392).

CROSS-EXAMINATION

The clearances on the F–2's, E–1A's, 3100's and K engines are all pretty close. The clearance is over two inches. It is just enough so that you can get your hand in comfortably. If you get your arm or your elbow up around the lever at the end of the forward or backward sweep, you are liable to get pinched. These classes of engines were our older type of power. The E–1A's are all gone. We have the F–2's yet and a few of the K–11's (T. 395–396).

With reference to the occasion when my arm was injured, I got this locomotive from another crew at Watertown. It was customary to ask the engineer whom I relieved how everything was, and he said, "Everything is all right." We didn't have much time to

examine the lubricator. I took it for granted it was all right. There was plenty of oil in it, but it wasn't being fed heavy enough. I first noticed that the valves were dry going into Lacona about 22 miles from Watertown. The lever was rattling, and I got the indication from it. I didn't have a chance to look at the lubricator then. It was a hydrostatic lubricator, with a glass, so that I can observe the number of drops of oil that are being fed. I was going to adjust it and see how it was after I left Lacona. The accident happened while I was adjusting the lubricator after I had left Lacona, about 4½ or 5 miles. I ran about 2½ miles without adjusting it. There are conditions you have to look out for on leaving Lacona. I threw the lever back, as I supposed, to the center position, but it got two or three notches beyond center, and I did not realize that at the time. I was not working steam; the throttle was shut off. The lever was in back motion, and we were going ahead, which is a very bad condition and forms practically a pump. Because of that
93 the lever went forward when I released the latch to let it down again. I think that had a lot to do with the accident. The lever acted differently than it would have acted if I had had it on exact center and started to let it forward. I have handled engines that I could throw over like that, but I couldn't handle this one at 45 miles an hour. I had done it on others at 10 or 20 miles an hour, but 45 miles an hour is too much to do it. I didn't have strength enough. In ordinary running there is no occasion to do that at such a speed. It was just when I moved the lever out of my way so that I could look at the lubricator that this happened (T. 396–398).

I have operated the Franklin precision, Alco and Ragonett types of power reverse. I never saw any of them creep except the Franklin precision gear on just one occasion, with one engine. I reported the engine when I got in and they remedied it. I took the same engine out the next trip and it was all right. As to whether I have had occasions with one or the other of these power gears when I operated the lever or wheel, that the reverse gear failed to move the valve gear, we have had a little trouble with the Alco with the exhaust freezing in extraordinarily cold weather, but they have overcome that by piping the exhaust into the ash pan. We don't have any more trouble there. When they froze up you could not move the lever. That happened while we were standing still and I just thawed out the exhaust nipple with a piece of waste. It was outside of the cab but I could reach it from the inside with a torch. I have never heard of any of the gears freezing up while running, but if so I would have had to have had to have gotten outside in order to thaw it out (T. 398–400).

In the event of the air pipe leading to the power reverse gear breaking, you would use the auxiliary steam connection and operate the gear with steam to get in. We have an auxiliary steam pipe connection on the Alco, but I think they have cut it out on the Ragonett. I never have had a case in which the air gear went
94 out of commission on the road on either type of power reverse (T. 400–402).

I have been running steadily as an engineer since 1903, and have run smaller engines than the 4–4–2's which I have described. These smaller engines were 2–6–0's and were much smaller than 80,000 to 120,000 pounds on drivers. Of the last 27 years I have spent probably five or six years running locomotives weighing 170,000 pounds on drivers, and less (T. 402–404).

The accident I had on September 24, 1929, is the only accident I have had that I know of has been reported to the Interstate Commerce Commission. I have had minor accidents and have pinched my knuckles. I commenced running power-reversed engines in 1926 or 1927 and prior to that time had been operating manually reversed engines (T. 404).

PATRICK FLOOD, a locomotive engineer, employed by the New York Central Railroad Company, was sworn and testified as follows:

DIRECT EXAMINATION

I reside at Chatham, N.Y. I was hired by the New York Central as a fireman in 1902 and was promoted to engineer in 1905. My seniority district is Chatham to New York. I have had experience in all classes of service, and at the present time in milk-train service. I use 4–6–2 type of engine, weighing about 170,000 to 200,000 pounds on drivers, some of which are equipped with hand levers, and others Franklin precision-power reverse. I have also had experience on 2–8–2 type of locomotives, weighing 200,000 to 250,000 pounds on drivers and experience on lighter locomotives than that 23 or 24 years ago, but that time is kind of out of my memory (T. 405–407).

With reference to the 4–6–2 engines I have described that are
95 manually reversed, it takes quite a lot of weight to reverse the engine or hook it up. I have had no difficulty with the lever jumping out of the quadrant on that class of engine. I did with a 2–8–2, but only in a case where running 35 or 40 miles an hour the engine stripped itself and naturally that threw the lever off and it went down into the corner. I have two occurrences of that kind. I have never been injured by a manual lever jumping out of the quadrant and catching any part of my body (T. 407–408).

I have been injured by a manual lever on two different occasions. In July 1929 I was going to take a siding near Millerton with a milk train and had to take slack in order to get the cars started into the switch. I had the lever in the forward corner, and got started pretty well and determined to pull it back a little. As I did so, I braced myself with my foot, and all at once the engine went spinning as hard as it could go. I hung right on to the lever and it went down with me, down on my leg. I took one hand and tried to shut off the throttle but could not, and the conductor and fireman came to help pull the lever off my foot. The lever pulled me with it. I didn't let go of it. I was saving my foot. I did not report the accident because they had a safety drive on and we hadn't anything reported yet. I was off four days (T. 408–410).

I was injured in August 1930 in hooking up one of our K–11's, a 4–6–2 engine, weighing 170,000 to 200,000 pounds on drivers, equipped with a manual reverse, and being used in through milk-train service. I was running about 45 miles an hour, and after I had gotten over a hill I wanted to hook up the lever one more notch. I put my foot up and gave it a good pull. I don't remember whether my foot slipped or anything but I know I felt a little sting in my groin. I had about two more miles to the water stop. I examined myself and found I had a little lump there. I reported it and when I dead-headed home the claim department sent me to a doctor
96 and they sent me to the hospital to be operated on. My condition was found to be a double hernia. I was in the hospital 21 days and was off about 100 days altogether. The company paid the doctor and hospital bill and half time amounting to about $35000 (T. 410–411).

I have had experience with power reverse using them perhaps a year at a time. I have never had any difficulty in operating it or any occasions when it became inoperative. As to the relative speed with which a power reverse accomplishes reversing the engine as compared to a hard operating manual bar, I wouldn't know how long it would take to get a hard working manual bar over, but when either one of them is working well one is about as quick as the other. As a matter of fact the air reverse is much easier. When I am working a hard operating manual bar I take the same position in the cab as at any other time. I can handle one all right except in case of reversing, then I sometimes will have to get help. When I have to get help it does not move as quickly as the air reverse (T. 411–412).

CROSS-EXAMINATION

On the two occasions when the lever jumped out of the quadrant and the locomotive was stripped I could not account for the occasions in any other way except that it was a breakdown. The knuckle pin came out and that is what caused the breakdown, but I don't know what made the lever come out, although I suppose the breakdown did. I didn't have that happen with the lever at any time other than when I had a breakdown. When I speak of stripping the engine it tore off the rods, guides, and part of the cylinder. It took eight hours before we could move the engine. The engine would have broken down just the same, whether we had a hand lever or power reverse gear. In those cases the lever went to the forward end of the quadrant but the quadrant was not torn off nor moved in the cab (T. 414–415).

97 The only type of power reverse we have is Franklin Precision. The control of that apparatus is located in front of the engineer's seat, fastened to the boiler by some screws or lugs. I don't know whether the bracket, which is made of iron or steel, is bolted direct to the boiler or bolted to something else. The wheel is 10 or 12 inches in diameter. The screw which turns when you move

the wheel is located in front of the wheel, and slides up and down between two blocks. The screw is about a foot long and has a thread on it. A reach rod is connected on the front end of the screw block and extends through the front end of the cab in a downward position to the connection in the rear of the air cylinder. The air cylinder is fastened to the running board forward of the cab. I have never had an accident in which a power-reverse locomotive was stripped. With reference to the accident in August 1929, I was using both hands in operating the lever. I believe the New York Central has been equipping its locomotives with power reverse as fast as they go into the shop and come out. I do not know whether that is the case with just the heavier locomotives. We do not have any light ones in our division, and I don't know what they do with the light ones. I am 51 years old. As as to the occasion when the lever came against my foot, I went to hook the engine up and it pulled me down, and I still had both hands on the lever. I couldn't get it back and I reached up to try to shut off the throttle, but I could not, and the conductor and fireman came to my rescue to help pull the lever off my foot or leg. It was up above the ankle. I had placed my foot on the back end of the boiler. We do not have a foot brace on that engine or on any of our engines that I know of. I do not remember seeing any foot brace. There wasn't sufficient clearance between the boiler head and the lever when it was in
extreme forward position to permit my foot being there with-
98 out coming in contact with the lever. What it caught against
was the train line or control valve. The lever had farther yet to travel. My leg happened to be in its way. That valve must have been right close to the quadrant. It extends up perhaps 18 inches from the floor, while the quadrant is about level with the running board. The accident when I was ruptured occurred on August 29, 1930. My experience with power reverse has been confined to the Franklin Precision gear, which I first used about five years ago. I was in electric service prior to that time about 12 years, and the rest of my time was spent with manual reverse gear. My experience so far back as I can remember has been on engines weighing 170,000 pounds on drivers and more (T. 415–425).

B. A. SNODDY, a locomotive engineer employed by the C. C. C. & St. L. Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Anderson, Indiana, and have been in engine service with this company for 24 years, beginning as a fireman in 1907, and then being promoted to engineer in 1918. I run on the Michigan division from Benton Harbor, Michigan, to Louisville, Kentucky, and have had experience in practically all classes of service. At present time I am firing a freight engine. We have two types of switch engines at the present time, an 0–6–0 weighing about 135,000 to 150,000

pounds on drives, and 0–8–0 class weighing 216,000 to 276,000 pounds on drivers. At the present time all of these engines are power reversed. Formerly they were all manually reversed, and I have had experience on them with each type of equipment. Our freight engines are 2–8–2's weighing from 200,000 pounds to 246,000 pounds on drivers. About half of them are power reverse, and half manual reverse. We are using the Alco power reverse. Our passenger engines are the Pacific type weighing 142,000 to 186,000 pounds on drivers, all manually reversed (T. 425–428).

99 With reference to the manually reversed 2–8–2 freight locomotives, clearance is pretty close between the foot board and seat box, perhaps two or three inches. Some are closer than that. On some of them you cannot get your foot between the quadrant and seat box. When sitting on the seat box the room for your foot and legs ahead of the seat box varies. On some engines it is pretty close there, owing to the arrangement of the brake valves, independent valves and piping; your legs are close to those pipes. The lever sometimes goes down right against the boiler head. We usually put a stop block to catch the lever from going smash up against the boiler. The lever in full backward position usually goes out into the deck, usually past the rear end of the cab, and that is dangerous, for it is liable to catch your hand between the side of the cab and the lever (T. 429–430).

Sometimes the lever can be operated without effort, and other times it takes both you and the fireman to pull it up. The company does not furnish foot braces, but we generally get a block and nail it on ourselves (T. 430–431).

I have experienced the lever jumping out of the quadrant quite a number of times. Sometimes they rattle and give you an indication they are going to jump, at other times they do not give you any warning whatever. Your lever will be on your left side and it will be jiggling around making a racket, and sounding like it was tearing everything off. If your engine gets a little bit dry, or if there is lost motion in the valve, it jumps out of the quadrant. When it jumps out it goes bang right down to the front. If you happen to be under it it would be pretty dangerous, if it happened to catch you, your foot, arm, leg or anything. On one engine I had a manual bar break off at the fulcrum bolt where it is bolted to the frames, and go back and forth from one end of the quadrant to the other and whipsawed

100 back and both until we got the engine stopped. Other causes for the lever jumping out of the quadrant would be, a loose quadrant at either end, or quadrant bolts being loose, bad latch, or latch teeth, or teeth of the quadrant being worn bad, long reach rod having lost motion, the reach rod being 15 or 18 feet long. We have bad water and use a compound; the water foams very bad and we can make only about two round trips without having the engine washed out or we have a good deal of trouble. When the engine is foaming it washes the valves dry (T. 431–433).

Having in mind a switch engine weighing 135,000 pounds on drivers manually reversed, with Stephenson motion and slide valves, such an engine would be reversed in yard service on the average once every half minute or minute, and I judge we maintain this average for about half the time of an eight hour shift. We have drop seats and would have to stand up on this engine, or sit in the window so we could look out to get signals. All our movements are made in back up motion at present. Sometimes, on a factory job, we work from 14 to 16 hours, and you get pretty tired on such a job and are about all in before you are through. I have had to have assistance many times to throw the engine over in yard service (T. 433–436).

Since these same engines have been equipped with power reverse we can sit on the seat box part of the time and take signals, because some of our movement is in forward motion on this up town job. It is not nearly so hard work, and you do not necessarily have to take your attention from the men on the ground to reverse the engine. With manual reverse most of the time you have to leave your position in order to reverse the engine into forward motion. Ordinarily it will take longer to reverse the engine with hand reverse, because you have to leave your position and walk one step over and get hold of the lever, and it depends upon how hard it is and in the direction in which you are going. With power reverse I have experi-
101 enced no *no* difficulty in throwing over the engine (T. 436–437).

I have had experience with old Standard engines 4–4–0 weighing about 80,000 pounds on drivers, with Stephenson motion and D valve, manually reversed. They handle hard most of the time. We had the same water conditions then we have today and they would get dry and run long hours without oil. The lever jumps out of the quadrant and goes to the corner very often with those engines. The slide valve would get dry, jerk about, and sometimes break off the valve yoke. They were balanced valves but did not maintain their balance very well. We had another class of freight engine known as a Richmond engine weighing about 120,000 to 130,000 pounds on drivers, Stephenson motion, slide valve, manually reversed. They are usually very hard to reverse. We also had Mogul engines 2–6–0 weighing about 100,000 pounds on drivers, with Stephenson motion, slide valves, manually reversed. They were not so hard as the other engines. I have had experience with the Atlantic type of engine weighing from 108,000 to 119,000 pounds on drivers, Stephenson motion, piston valves, manually reversed. At times they would reverse very handily, but other times I had to have the fireman help me. I recall running one of these engines three years ago and I had to keep my hand on the reverse lever continually, or else use a monkey wrench at the top of the latch, to hold the lever in position. Eventually I held the latch by using a cotter pin into a hole I had bored through the steel (T. 437–442).

I was injured in operating a manual reverse lever on April 16, 1929, near Milroy, Indiana, while running engine no. 6147, a Mikado

of the class weighing between 200,000 and 246,000 pounds on drivers, in local freight service. The clearance around the lever and seat box was very close in front due to the brake valve and piping arrangement in front of the seat box. You couldn't get your feet between the seat box and quadrant, and when you wanted to go around
102 the lever you stepped over the seat box or else had to place the lever in back motion. We were going into Milroy running about 40 miles an hour, and I was sitting leaning out of the cab. I was gauging the speed as to about how fast we were running, and about the distance where we wanted to stop. We had one car we wanted to drop into the team track, so I just didn't take my eyes from the outside. I gradually shoved the throttle off and the reverse lever went right down into the corner without any indication whatever. It struck me on the side of the leg about four inches above the ankle bone and then dragged me down between the boiler head and the lever and then beat my leg up, beat both bones by striking me every time the engine turned over until I got it stopped. I had difficulty in stopping the engine and in finding the brake valve. While I was trying to get it stopped my train went about forty car lengths. The accident did not take me off my seat box but dragged my foot between the boiler head and the reverse lever, and I couldn't get away. I don't remember whether I was able to keep a lookout when I was caught in that position, but I don't think I was. I judged we were about a half a mile from the station. I was unable to take the train in, and the fireman ran it into the station. They called a doctor who put a splint on my leg and sent me back on a passenger train to my home 45 miles away, and they set my leg that evening. I was off duty 86 days. The company paid me about $500.00 and the hospital and the doctor bill (T. 442–446).

About two weeks before that on the same run I had this lever jump out of the quadrant. We were running at about the same speed, 40 miles an hour. It didn't give me any warning that it was going out. It just went down with a crash into the corner. I had to reduce speed to eight or ten miles an hour before I could pull it up. I had a fireman who was a bigger man than I was
103 and he and I couldn't budge the lever and pull it out at that rate of speed. We found that the bolt at the back end of the quadrant was loose and allowed the quadrant to work up and down (T. 446–447).

My experience with power reverse is that it is much easier than the old hand reverse. It is fast and there is not so much work about it. I have never had a breakdown of any kind with a power reversed engine. I am 53 years old, and have been back firing about ten months (T. 447).

CROSS-EXAMINATION

On the occasion when the lever jumped out of the quadrant and the back end of the quadrant was loose, I tightened the quadrant myself. I don't remember whether I reported that. At that time

the Baltimore & Ohio took care of our engines at the end of the road toward which we were running. Our instructions were not to report anything to the B. & O. unless it was an absolute breakdown. We were supposed to make an inspection and work report of our trip at our own terminal, but not at that time at the B. & O. end. I did not handle that engine back to my own terminal the following day, which was Sunday, but I did have it back on Monday. I did not make any report when I got back to my own terminal, because I had no trouble with the engine coming back. We had a heavy train and the lever didn't jump out of the quadrant because I had tightened it myself. That was the last trip I had this engine until I had my accident, as I was in extra service and just happened to catch it on these days. The time when I was injured was the only time the lever had jumped out of the quadrant that day. I had not made any inspection of the quadrant or valve gear to determine what caused it to jump out on that day because the engine had not given me any trouble that day until the lever jumped out of the quadrant, and of course after I was hurt I did not see the engine any more, and I never knew what the
104 cause was. As to whether I had run this engine on occasions other than the ones I have mentioned when the quadrant bolt was loose, and we have so many engines in pool service and catch them so irregularly that I don't know about that. I am able to state how that reverse lever performs only at the one particular time that I know it jumped out of the quadrant. If, at the B. & O. end of my run, running repairs were necessary if you couldn't make them yourself, or if there was an absolute necessity as a safety proposition, or if the engine couldn't be run back without them, you were supposed to telegraph your traveling engineer for an order to have the work done, and you could get it done in that way (T. 447–452).

On the locomotive on which I was injured the reverse lever extended up about 4 feet high from the deck of the locomotive. The quadrant, which is an arc shape, was just about on the level of the floor at its forward end, where the engineer's feet rest, perhaps a little bit below the level of the floor, and as you come back along the quadrant the center of it is perhaps four or six inches above the floor level. They are different on some engines. Some are more pronounced than others (T. 452–455).

At the time of my accident we were going forward about 40 miles an hour, and I was leaning out of the side of the cab window, looking forward.

"By Mr. MOREHOUSE:

"Q. And you moved your leg to the left so that it was in position directly in front of the reverse lever?

"A. Well, it was near that, enough to catch me, at any rate.

"Q. What I want to know is this: I want to be fair to you. I understand you to say you put your foot over there to brace your-

self. But if you had kept your foot on the floor in front of
105 you or had it placed in any other position to brace yourself there than sticking it in front of the lever, then your foot wouldn't have gotten caught, would it?

"A. No; the chances are it would not if you hadn't put it over there. But naturally we have to have a brace of some kind, and we are not always conscious of just exactly where our feet are going when we are watching something else (T. 455–456)."

As to whether it had ever occurred to me to place some sort of a guard alongside of the quadrant and to the right of it as I face forward, I will say there is no place where you can bolt it on this particular engine, and I don't know how you would put a guard there. We have a block nailed on the floor to guard against that point but on this particular engine there is no place where you could have done that. I don't know whether there is any way you could put a piece of sheet metal or wire mesh along there in some way so that you would not get your foot over in front of the lever. I know that this had been requested by the men. We fought that question quite a good deal. We made the request to the roundhouse foreman, also the traveling engineer. I do not know that I myself ever made any particular request to have a guard put there. I said we had fought that question among ourselves to try to get something put there, although I didn't say that I had made any particular request myself (T. 457–458).

As to the older types of engine I was asked about, I don't recall that we have but one of the Richmond engines in service on our road, and as to the 2–6–0 Mogul type weighing about 100,000 pounds on drivers. I don't think there are any of these still in service. We have none of the Standard engines 4–4–0 in service on my division (T. 458–458).

106 As to the lever jumping out of the quadrant on that old engine because of breaks in the valve rings or valve gear, or parts not being properly maintained, those are not always occasions when it jumps out. It would get dry and sometimes it would be caused from vibration, and sometimes they jumped out for some reason, and I didn't know why, but they would go down, anyway. You cannot always determine the reasons. They usually went down very hard when they did, and there was no chance to hold them. They were the old Stephenson motion engines, and naturally with that gear they went to the corner very fast. The Walscheart gear is an improvement over the Stephenson gear, but I have had them go down with it. I cannot agree that there has been a good deal of improvement in the operation of the hand lever on modern power as compared to the old-fashioned types like the Standard engine. I should not say that they work easier because of the improved valve motion. I have strained as much on the larger engines with the old valve gear and piston valve as on the old Stephenson gear. I am speaking of these engines generally, the way we get them on the

extra board. In comparing the old standard engine with the modern type of engines, both manually reversed, when they are both working properly without dry valves or broken rings, or dry bushings, or other things that make them work hard, I do not agree that the more modern engines operate better (T. 459–461).

We use a block on practically all of our engines to keep the lever from going up against the boiler head in extreme forward motion. We usually use a block of iron sufficiently long with a bolt through it and through the front end of the quadrant that would fit in the quadrant so as to catch the lever as it went down. It would keep the lever from going clear down along the boiler head, and we would apply a block of whatever length was necessary to give us clearance. We never had any trouble with our railroad putting this on when we asked them to (T. 461–463).

107 We have no foot braces on our locomotives except those we put on ourselves. We usually get a block of wood sawed out to fit the particular place where we can connect it and nail it to the foot board (T. 463).

We sometimes use the lubricator to increase lubrication when we find the valves are getting dry. Sometimes we do not have the oil to use. Quite often on our long run, with bad water and the small lubricators we have on these engines, they run dry before we can get into the terminal. Additional oil is pretty hard to get. It is like getting into a bank to get additional oil. I don't know of any particular case so that I can recall day and date, but we do that quite often. About ten days ago when I was firing we ran an engine from Marion, Indiana, to the terminal, a distance of about 33 miles, without a drop of oil. The lubricator went dry and we had nothing to renew it. We have that happen once or twice a week. It happens that often to other fellows where we have a 165-mile division. We have only a four-pint lubricator, and bad water, and you can run out of oil pretty easily under those conditions. We do not make a note of that on our work report. The contention of our officials is that 50 miles on one of those engines without oil will not hurt them a bit. That has not been my experience. I do not think any engine ought to be run without oil. These occasions were with power-reversed engines. I cannot recall an instance in the last year where I have run a manually reversed engine dry that way (T. 464–465).

I commenced running power-reversed locomotives in 1912 and from that time on I estimated that three-quarters of my time has been on manually reversed engines. Power-reversed engines have come on our division only recently in the last three years, since we have got later and heavier power. I have been running manually reversed engines about 13 years, and of that time four or five

108 years, I would estimate, have been spent on locomotives of 170,000 pounds on drivers or less (T. 466–467).

REDIRECT EXAMINATION

As to whether in the operation I was performing at the time of my injury which was looking out, I could have conveniently kept my feet straight ahead of me, I couldn't do that on that engine. I answered that I would have been torn off the seat box if I had sat in that same position without a brace. I have an arm rest. I can cock my head out of the window and look forward out of the side window with my feet on the floor (T. 468).

ELMER T. HAIRE, a locomotive engineer employed by the Michigan Central Railroad Company, was sworn and testified as follows:

I live at Bay City, Michigan. I was hired by the Michigan Central in 1902 and promoted to engineer in 1907. My seniority district is from Bay City, Michigan, to Mackinac City, Michigan. I have had experience in practically all classes of service, and at the present time am firing a mixed run. Recently my experience has been mostly in yard service. In yard service we have 0–6–0 type of switching engines, some of which weigh about 136,000 pounds on drivers, and are manually reversed with Stephenson motion and slide valve. Others are 165,000 to 200,000 pounds on drivers, and are equipped with Ragonett power reverse. We have the U–25, a 0–8–0 class, weighing about 215,000 pounds on drivers, equipped with Ragonett power reverse. In freight service we have a 4–6–0 engine weighing 100,000 to 140,000 pounds on drivers, manually reversed with Stephenson motion and slide valve; the G–6's, a 2–8–0 class of engines, weighing 200,000 to 250,000 pounds on drivers manually reversed: and the H–7's, a 2–8–2 type, weighing 250,000 to
109 300,000 pounds on drivers with Franklin Precision power reverse. In passenger service we have a 4–6–2 type of engine weighing 140,000 to 170,000 pounds on drivers, manually reversed (T. 469–473).

On our G–6, 2-8–0 freight engines weighing 215,000 pounds on drivers, that are manually reversed, the clearance at the back of the cab with the lever in full back motion is pretty close. There is just about room for your hand, and in full forward motion they are pretty close to the boiler head and the brake valve. The amount of strength required to reverse one of those engines depends upon conditions. It takes a lot of strength under certain conditions and under other conditions not so much. On our division cold weather, ice, and snow, which we experience generally from four to five months of the year, are the conditions requiring a good deal of strength. The link motion, or the links and link blocks get frozen up and full of ice and snow. I have often had occasions when I couldn't move the lever in either direction, even with the assistance of the fireman, and we had to build a fire with a piece of waste under both links and thaw it before it could be moved. Snow comes through many different places in the cab, through cracks and crevices, and around the curtains, and makes the quadrant, the reverse lever,

and myself wet. The notches of the quadrant often become wet and full of snow and ice. With these G–6 engines you can sit on the seat and put your foot up on the boiler head or brake pipe, and if you have power enough you can pull the lever back, but if you haven't you have to get the assistance of the fireman (T. 473–475).

I have had the experience with the lever jumping out of the quadrant and going to the corner; sometimes it will act all right, and then again it will vibrate. I have had them jump out when the engine was apparently in perfect working condition. It goes to the full forward motion with great force, and there is
110 plenty of danger if you get in front of it. I don't remember having the lever jump out of the quadrant in back-up movement. We have so little back-up movement to make, no more than in switching. As to the causes which make the lever jump out of the quadrant, there are several things that might cause it, but it is a characteristic of the manually operated gear. This is true regardless of the type of valve gear, whether Stephenson or Walscheart (T. 475–476).

As to the 4–6–0 freight engines weighing 112,000 to 140,000 pounds on drivers, equipped with Stephenson motion and slide valve, the performance of the lever is practically the same as it is on any of the rest of the manually operated reverse levers. Under certain conditions it is liable to jump out of the quadrant, and is very hard to hook up from the forward corner when running. As a rule when the engine is standing still with no steam in the cylinders it is comparatively easy to get the lever as far as the center, but after you are required to put it from center towards the back motion it is comparatively hard. I have seen times when I have had to get off my seat and throw my weight on the lever in order to force it into back motion. As to the manually reversed 0–6–0 engines weighing 136,000 pounds on drivers that are used in switching service, under good conditions these reverse fairly well, but in cold weather, or with snow, they are the same as the rest, and are hard to handle. I have never had very much experience with these going to the corner because we do not have occasion to work a short cut-off much around the yard, although I do remember of their going into the corner in a few instances. When our B–10, 0–6–0 engines weighing 165,000 pounds on drivers first came to us they were manually reversed, and it was almost impossible for a man of ordinary strength to reverse it. The only way you could do it would be to throw your weight on the lever and pull a little bit at a time until you got them from forward to back motion. They were new engines at the time.
111 After they had been in service for a while, and were thoroughly broken in, under fair weather conditions they worked pretty well, but in cold weather they worked hard. After they were equipped with power reverse I never had any trouble in reversing them in cold weather. I never experienced any difficulty at all in handling engines equipped with power reverse in cold weather. I never had the air exhaust pipe on the air cylinders to freeze up. I

would say I have had four or five years out of my twenty-four years running in road service. Handling the reverse lever is more difficult in road than in yard service, owing to the fact that you have to work the engine at different cut-offs in road service, while in the yard you reverse it from one end of the quadrant to the other. There are not as many operations in the yard in regard to the running part of it. There is more necessity for power reverse as a safety device in road service than in yard service. This condition does not vary as between passenger and freight service on the road. The comparison between road and yard service which I made is a relative one and there is certainly an element of safety involved in yard service. I am 49 years old (T. 476–480).

CROSS-EXAMINATION

It would not be altogether fair to say that in my opinion the principal advantage of the power reverse in yard service would be the saving of labor in throwing the bar from one end of the quadrant to the other. The principal advantage as I see it would be to keep from getting hurt. I have had experience in yard service with the lever jumping out of the quadrant on a few occasions, and there might be an element of safety in that. I have in mind that, in yard service, power reverse works easier and faster. I have had approximately 10 years in yard service. I can switch more cars in
the run of a day's work on a power reversed engine than with
112 a manually reversed engine, and the difference amounts to
quite a lot. The expression "the lever jumping out of the quadrant" is a railroad man's term for the operation in which the latch releases and the lever move to extreme forward position. As to my experience in having a lever jump out of the quadrant in yard service that would date back before power reverse was put on the D–10 engines, around about 1917. I would say that it had happened a half dozen times at least. I did not get hurt; I was not in front of the lever. Knowing that thing might happen I would keep away from in front of the lever if it was possible (T. 480–484).

As to the limited clearance on the G–6 engine of which I spoke, I have never measured the amount of clearance but would say it was a couple or three inches, a little more than the thickness of the hand at the back end of the swing. In front they are about two or three inches from the boiler head, just enough room to get your hand in there. It is possible to provide more clearance by putting a stop on either end of the quadrant, but if you did you would block your engine so that you couldn't get it in full forward motion with your reverse lever blocked half way up the quadrant. If you blocked it an inch or two more up the quadrant and had a tonnage train with all the engine could pull, if it were not clear in the corner you couldn't pull it (T. 484–485).

It was the Walscheart motion which I had to throw out on several occasions in cold weather. The last time I remember doing this

was about three years ago. As to the time before that I do not recall. I have done it so many times that I never have kept track of them. It happened every time you got out in a snow storm with the weather down to 40 degrees below zero, or thereabouts. I don't remember how often those storms were, perhaps once or twice a week, or maybe you would get two or three in a week. Forty
113 degrees below zero is cold weather, but I have seen it colder than that. I first operated a power reverse locomotive in 1917 or 1918, and since that time I have operated the two types about an equal amount. I am not able to say how much I have run the 0–6–0 yard engine weighing about 136,000 pounds on drivers, but would say periodically from five to ten years. I have run the 4–6–0 freight engines weighing 100,000 to 140,000 pounds on drivers with manual reverse, off and on since 1907, but would not be able to tell how many years. I have only run two trips on passenger trains (T. 484–487).

W. B. SOUTHARD, a locomotive engineer employed by the Michigan Central Railroad Company, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Jackson, Michigan, and am a member of the Brotherhood of Locomotive Firemen and Enginemen. I hired out as a fireman on the Michigan Central in 1906 and was promoted to engineer in 1916. I have had experience as an engineer on the five divisions running out of Jackson. My experience has been mostly in through-freight service, but I have been in yard service and a few trips in passenger service. All of the engines used in through-freight at the present time are equipped with power-reverse gears. They are the 2–8–2 class, weighing from 245,000 to 250,000 pounds on drivers. In local freight we have a few G–6's, a 2–8–0 engine, weighing about 215,000 pounds on drivers, which are manually reversed. I have run some K–8–0's, a Consolidated type of passenger engine, weighing 170,000 to 200,000 pounds on drivers, manually reversed. We have at the present time only one Stephenson-motion engine, an F–28 used in work-train service, weighing about 160,000 pounds on drivers (T. 489–491).

On the 2–8–0 engines weighing about 215,000 pounds and used in freight service which are equipped with manual levers
114 the lever has a good clearance along the side but very short clearance in front of the boiler. In full back motion the end of the lever projects back of the cab wall about six inches. On some of these engines the levers are easy to handle and some of them very hard. There are no foot braces furnished. In reversing the engine it is necessary to get off the seat box, step over the quadrant on to the deck, to bring the lever into full back motion. There is always more or less danger in handling a hand-reverse gear. I have required assistance at times to throw over the lever. I have experienced the lever getting out of the quadrant while I was running

along. In running there is always more or less vibration and jerking back and forth, and at times that will become so great that the latch will raise and the lever will go into full forward motion. It will get there so quickly it can't be stopped. There are various things that cause it. In snowy weather the quadrant becomes wet and slippery, and if there is more or less wear in the bearings and connections that will cause it. A dry spell or rough valve chamber walls will do it (T. 491–493).

I was injured by operating a manual reverse lever on November 20, 1927, about one mile west of Lawton, while operating a K–80 passenger locomotive weighing between 170,000 to 200,000 pounds on drivers. We were running along at perhaps 50 miles an hour, and without any warning any more than there had been from the reverse lever vibrating and jerking, it unlatched and went to the corner. I closed the throttle and gave the engine time to work the steam out of the cylinders, and put my foot up against the boiler head, reached down and got hold of the reverse lever, and started to draw it up. I got perhaps a little better than half way to the center, and it was jerking back and forth, and it overbalanced me and took me down with it. As I went down I let loose of it. It gave me a sudden jerk and doubled me over and took me off the seat box onto the floor. Then I applied the brakes and reduced the speed down to about 30 miles an hour and got off the seat box, and asked the fireman to help me hook the engine up to where it should be, and I released my brakes and went on. I had fractured two ribs. I was off duty from November 21 to December 29th (T. 493–495).

I have had experience with power reverse and I would say that it is 100% safer than manual reverse, because there is absolutely no danger of getting hurt with power reverse. There is nothing there to injure you. The power reverse is very much easier to operate than the hand reverse. I have never had any difficulty in reversing an engine with power reverse, except at times there might be a tight bearing and the precision gear will turn a little hard. There is no danger in this condition with the precision gear. It just requires a little more strength. I have never seen one I could not turn with one hand (T. 495–496).

CROSS-EXAMINATION

At the time of my accident when I tried to raise the lever, I had reduced speed from 50 miles an hour to approximately 40 miles an hour. I had not applied the brake or opened the cylinder cocks, but I had shut the throttle clear off. I can't say from my experience that if you leave the throttle slightly open that it makes the lever pull back more easily than if you shut it off altogether. I have had experience in trying to pull the reverse lever back at 40 miles an hour. I always shut the throttle off that way. After I had been thrown forward, as I described, I put on my brakes and brought

the train down to about 30 miles an hour, and with the assistance of the fireman was able to pull the lever back, perhaps two or three inches below the center. There is no reason why in the first instance I should not have pulled the lever back two or three notches at a time. I customarily handle it that way when I am start-
116 ing the train (T. 497–498).

With reference to the G–6's where I said it was necessary to step down from the foot board deck to the main deck in order to put the lever from forward to extreme backward motion, that is not necessary wholly because of the extreme rearward position of the lever to the back board; it comes back so hard and so far you can't sit on the seat. The lever is clear back of you. When you are hooking up the engine to get a shorter cut-off you customarily operate the lever on this engine from the seat box. I do not have a foot brace. You get out in the deck when you pull it clear back so that you can get the full length of your arm and the weight of your body with it. The lever is about four feet high from the deck of the locomotive and you have to pull it 5- to 5½-foot sweep in reversing the engine (T. 498–500.)

I have used this particular type of engine in local freight service between different points. You are required to throw the lever from extreme forward to extreme backward position many times in handling a heavy string of cars, to get the train started.

The Michigan Central has been equipping its heavier engines with power reverse gears in recent years, practically all of them are so equipped. The larger engines that have been bought in recent years have all come equipped with it. They have put the power reverse gears on all of the H–7 engines, and the H–10 engines had them when they came. There are still a few G–6's in service equipped with manual reverse. I only know of one F–82. There are perhaps ten or twelve of our K–80 engines in service in my territory (T. 500–501).

I expressed my opinion about power reverse gears being 100% safer than hand reverse because I said there is nothing to hurt a man on power reverse. If I knew that men had been hurt with power
117 reverse I suppose I would have to *to* change my opinion, but I don't see how it could be done. My opinion is based upon my own experience, and I have not seen or heard of anyone being hurt on one. I first operated a power reverse locomotive in 1917 or 1918. From 1917 or 1918 until 1923 most of my experience was with hand reverse, and since 1923 or 1924 we have had practically all power reverse. From 1917 or 1918 until 1923 probably seventy-five percent of the engines I handled were hand reverse. As to whether on my division a larger number of engines have been equipped with power reverse each year I don't know just what the number would be. I know that as fast as they went into the shop for repairs they came out with power reverse, and all the new engines that have come have been equipped with power reverse. On our road I think that reasonable progress has been made in installing power

reverse. I have never been an official of my brotherhood. I have not operated an engine in a number of years lighter than the F–82 which weighs 160,000 pounds on drivers. That is the lightest engine on my division at the present time (T 501–505).

REDIRECT EXAMINATION

An engine weighing perhaps 140,000 pounds on drivers is the lightest engine I have used in my entire experience as an engineer. That was when I went running in 1916. When I expressed the opinion that reasonable progress had been made in installing power reverse on our road I had in mind the territory in which I worked I don't know anything about the other territories. When I gave that answer I had in mind the heavier power which we are using on our division at the present time. I have been familiar with all five divisions, but I am not at the present time. My division extends from Jackson to Niles, over the main line and over the air line. I am 52 years old (T. 505–506).

118 J. R. PRICE, a locomotive engineer employed by the Chesapeake & Ohio Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Huntington, West Virginia, and am 55 years old. I was hired as a fireman in 1903 and promoted to engineer in 1906. I am now working in the Cabin Creek district on the Huntington division. My experience is mainly in freight and passenger service, very little yard service. At present I am in passenger service, using a G–7 class, 2–8–0 engine weighing 164,000 pounds on drivers, most of which are manually reversed and equipped with Stephenson motion and piston valves. On the main line all the heavy engines I know of in passenger and freight service are power reversed. They are mostly Mallets and Mikados. On the Cab Creek and other branches where I have had experience, they have a few Mallets, and others are G–6, G–7, and G–9. There are very few G–6s and G–7s now. The G–9's weigh 178,400 pounds on drivers and are practically all manually reversed, a 2–8–0 type. I have run these G–9 engines in switching and pulling loads at the mines. We had to handle them quite a bit, and they handled pretty hard when thrown in either forward or back motion. I would always have to get up to reverse them. There may be many men who could probably reverse them without getting up, but I never took that strain. It is more of a strain to try to reverse these engines sitting than it is to get onto your feet. The G–7's in passenger service do not handle so hard, but when I throw one all the way over I always get up, but when dropping it down and going forward all the time you don't have to get up. You can put your foot against something and ease them up or down. I never reverse them without bracing my feet. There

is no special place to put your foot, but you can place it against the boiler head. I have had difficulty with the lever jumping out of the quadrant as I was running along. That is when we are
119 working water pretty bad. Bad water dries the engine, and when you are working water it makes the engine dry and causes the reverse bar to work hard in the quadrant. As to the occasions when the lever jumped out of the quadrant, if you don't have hold of it it doesn't hurt you. It will go on down. All you have to do is to pull it back if you can. Last summer my engine was working water very bad, and I aimed to drop it down a little, and the lever took me right on down with it and would liked to have jerked me in two. I made no record of it. I have never had any injury, you might say, but only a mere jerk (T. 506–512).

I have had experience on a F–11 ten-wheel engines weighing about 115,000 pounds on drivers, with Stephenson motion, in passenger service. It was about all a man could handle. I never tried to handle it without getting up. I would have to get up and pull the bar back about the center and then get behind it and shove it on into backward motion. In forward motion you could pull it up to you, but I would have to get around kind of sidewise to get it by. I couldn't pull it by me sitting down. I didn't have room. I had to push against it in completing the movement (T. 512–515).

I was injured in operating a manual-reverse lever on December 27, 1928, at St. Albans, W.Va., on engine no. 390, an F–11, a ten-wheel engine, weighing about 115,000 pounds on drivers. When I came on the engine that morning I found the hostlers had left it with the lever in forward motion. The running board is about two feet from the deck on that locomotive. About half-way up from the deck there is a step. I had one foot on the step and the other on the running board to pull the lever over. It pulled hard, and my foot slipped off that step and I fell backwards into the deck and ruptured myself. The rupture required an operation, and I was off duty about two months. The company paid me $210.00 (T. 515).

120 I do not remember that I ever ran an engine lighter than 115,000 pounds on drivers. As to the handling of power reverse compared to manual reverse, it doesn't take half of the power to pull a power reverse engine over. It doesn't give you any strain whatever. It takes longer to throw over the manual lever. I have never had any difficulty in throwing over an engine with power reverse (T. 515–516).

CROSS-EXAMINATION

I weigh about 240 pounds and am 5 feet 11 inches tall. The dry weather last summer was the worst in my recollection, and they treated the water pretty heavy. That was the time I mentioned when I experienced trouble with the lever jumping out of the quadrant, but I had it jump out of the quadrant before this dry spell. It was more apt to jump out when you have a dry valve. Last year

was not the only time I have had dry valves. We have foaming water different times, but it was worse last summer. In previous seasons I had more or less experience with the lever jumping out of the quadrant. As to how often the lever would jump out it was every day or so. Sometimes you couldn't say what the cause would be. It would go down and I couldn't tell you. A dry valve will cause it for one thing. I don't know that I ever noticed anything wrong with the spring. They are not very heavy, not much bigger than a lead pencil (T. 516–519).

On the engine on which I was injured I said my foot slipped off of the step. The side of the running board is twelve or fourteen inches above the main deck where the engineer sits, and when I came on the engine that morning I put my foot on that step and the other foot on the running board, and caught hold of the lever to pull it in back motion. It pulled very hard and my foot slipped off and it threw me back. The step is about half-way up to the
121 running board. I had just come on the engine, and was throwing the lever before I got in my regular position in the cab. It was the fall that caused me to be ruptured. I think the engine had been dismantled, and that is the only one of its class that I know of on the division (T. 519–520).

When this bad water condition existed we used the blow-off cocks two or three times a day to counteract it. When the reverse lever jumps out of the quadrant it goes to the forward position, and we try to stay out of the way of it. We do not try to grab and stop it. When you get your jerks you have a dry valve, and you drop the lever down a little bit, and that is when you get your jerks. Knowing that that will happen at times, you naturally guard against it and brace yourself. The idea is you brace yourself and get ready to hold it and let it down easy. Because of that you keep your feet, arms, and hands away from in front of your lever. I think ninety percent of my experience as an engineer has been on manual-reversed engines (T. 520–523).

Mr. Thom, Jr., on behalf of defendants, stated that if it was the intention of counsel for plaintiffs that the testimony relating to expenses of and compensation to an injured engineer were to be considered as having a bearing upon the liability of the railroad, it would be defendants' desire to object and move to strike out all such testimony. He stated that complainants' counsel might make reply later.

A. K. Pearce, a locomotive engineer employed by the Seaboard Air Line, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Raleigh, N.C. I hired out on the Seaboard Air Line as a fireman in 1911, and was promoted to engineer in 1916. I run on the Virginia division, Portsmouth to Raleigh, and Raleigh to

122 Richmond. I have had experience in all main line and branch service, passenger and freight, but not in the yard. In freight service we have the 300 and 400 classes, a 2–8–2 type locomotive weighing 209,000 to 212,000 pounds on drivers, equipped with power reverse. Main line passenger service is operated by power-reversed engines weighing 210,500 pounds on drivers. On branch lines in mixed train work we have the 700 class, L–2, 4–6–0 engines weighing 132,610 pounds on drivers with Stephenson motion and piston valves, manually reversed (T. 525–527).

I have had experience with these 4–6–0 engines, and the clearance in the cab around the reverse lever is ample for a man my size. Occasionally I have experienced the lever working hard, and then they worked easily as the engine gets properly broken in. In reversing the engine, under ordinary conditions, I brace my foot against the boiler head to avoid strain. After the engine is broken in I am able to reverse it without assistance, but when it is new out of shop either the fireman or a helper, who is put on the help break in the engine, assists me in reversing it. On occasions when the oil gets away from the valve or the valve becomes dry, and perhaps because of tight bearings, the engine reverses hard (T. 527–529).

I have had the manual lever jump out of the quadrant and go into forward or backward motion when running along. On one occasion the eccentric strap broke, and jerked the lever out of the quadrant, and it went from one end to the other until the engine was practically stopped. I couldn't tell you how many times it went back and forth. I had the brake in emergency and was getting out of the way. It would go from one end of the quadrant to the other on every stroke of the engine. We went two or three hundred yards. We were running about 30 miles an hour when we applied the brakes in emergency. We were running light. I can't recall any other occasion just now when the lever jumped out of the quadrant. I have had them do it. It was a long time ago (T. 529–530).

123 I was injured by handling a manual-reverse bar on May 18, 1928, at Oxford, N.C., on engine 1564, a 4–6–0 type weighing 104,800 pounds on drivers. The clearance was good on this engine. I had taken the engine to Oxford and backed into the wye track at Oxford to pick up a car. It was standing on an incline. I tried to move and couldn't without catching slack. I had to be very quick to take slack to keep from losing the slack I had just caught. I reversed the lever from back over to front. There was no stop pin in the quadrant and my finger came in contact with the stud that holds the jacket on, mashing the nail to the bone. I lost fourteen days' time (T. 530–532).

I am of the opinion that power reverse is superior to manual reverse regarding safety, because I see no possible chance for a man to get hurt on power reverse. I have never had any difficulty reversing engines with power-reverse gear. The power gear has never become inoperative with me (T. 532–533).

CROSS EXAMINATION

I have been running steadily since 1916, with the exception of about two months. Perhaps the first two or three years after I was promoted I ran with manual reverse, and since then with air reverse, except during the dull season in the summer time for about two months, when I run everything that comes along. Practically all of the engines on main-line passenger and freight service are power reverse on our division. There is only one local freight which is manually reversed. We use Alco and Franklin Precision power reverse. The Precision is harder to operate than the Alco. The Precision wheel is about 12 inches in diameter. You have to spin it 17 times from forward to backward position. As to how long it takes to do that, this depends on how much of a hurry you are in. I never timed myself. I have never experienced myself, or known of an instance, in which the power reverse became inoperative (T. 533–535).

124 On the occasion when I was injured the quadrant had been set up backwards, and the stop pin in the forward part of the quadrant was missing. I consider the missing stop pin the cause of my finger being mashed. My interpretation of what I meant by there being plenty of clearance on this engine was that the clearance was between myself and the reverse lever, rather than the clearance at the end of the lever. In this instance if the stop bolt had been in place I couldn't tell you whether there would have been enough clearance so that my finger would not have been mashed. I can't say whether I ever operated this engine when the quadrant was properly set up. When an engine first comes from the shop it takes one or two trips to break it in, and in these instances a helper is furnished. After this one trip or so, I cannot say that I could handle the lever without trouble. It usually takes about ten days to get the engines broken in. After the ten days I cannot handle this without straining myself. There is some strain to it at all times. By handling the gear without trouble, I meant if the gear is in proper condition, and the valve and moveable parts lubricated. Lots of things have to wear in. The bearings are perhaps not properly fitted, and it takes that length of time perhaps to wear them to a good bearing. Since 1916 the injury I spoke of was the only one I had sustained with a manual reverse. I have never been injured by the lever kicking into the corner. On the occasion when I was injured I threw the lever forward into the corner, and it went too far because of the absence of the bolt. The missing stop pin is standard equipment on that class of engine (T. 535–539).

In demonstrating how I customarily reverse the engine when everything was working all right, I indicated that I was sitting on my seat and put my foot up against the boiler head and moved the lever, using both hands, past my left side. To pull it up from
125 the back to front I always get up. In pulling it from front to rear occasionally I get up. There is plenty of room for me

to turn sidewise on the seat box. I always put my right foot against the boiler head with the other foot down even with the quadrant if the reverse lever is on center. I can't say whether we have a foot brace. I do not think there is one on those locomotives. I have had two or three months experience all told operating the 4–6–0 engines in mixed service on branch lines. These engines are all equipped with manual gear. I am 41 years old (T. 539–540).

J. L. STAKEMAN, a locomotive engineer employed by the Chicago & Eastern Illinois Railroad, was sworn and testified as follows:

DIBECT EXAMINATION

I live at Evansville, Indiana, and am 73 years old. I hired out on C. & E. I. in 1881 and have been running an engine 46 to 47 years. At present time I am on passenger run between Evansville, Indiana, and Danville, Illinois. I have been in passenger service for the last 36 years. Most of the time I have been running an Atlantic type engine weighing 101,500 pounds on drivers, equipped with a manual lever, and having Stephenson motion and piston valves. We also have a Pacific type of engine weighing from 165,000 to 189,000 pounds on drivers, the five largest of which are power reversed and the others manual reversed. I have run power-reversed engines at times but not very much (T. 541–543).

On the Atlantic engines I am running there is two inches clearance between the lever and the boiler. The lever comes pretty close to the back board in back motion. There is no foot brace furnished except what you make yourself, or you put your foot against the boiler head. In hooking up or reversing an engine I generally
126 put my foot against the boiler head for help. On these engines the lever has jumped out of the quadrant, but I can't tell the incidents or the time. It has been some time ago. I never really knew what caused it but I think perhaps insufficient valve oil. Worn notches in the quadrant and dog, or when you are traveling pretty fast are liable to cause the lever to jump out of the quadrant (T. 543–544).

I was injured on one of these Atlantic engines by the manual reverse lever on January 31, 1931, near Evansville, on engine no. 210. I had my leg broke. That was on account of the lever going to the corner. I started to hook up the engine, and braced myself with my foot on the boiler head. When I raised the dog the lever took me into the corner and broke my leg. There are air pipes that come down from the brake valve, and I think I was hurt by them. I have not yet been able to return to service (T. 544–545).

While I have not had much experience with power reverse gears, they are mighty nice. They handle fine. They are up in front of you and not in your way. They don't keep you inside the cab if you want to see anything outside. You can look out either way if you want to, and still have your hand on the reverse lever and operate it.

If you want to see out, if there are any movements to be made, for instance, like starting away or making any other movements, you can handle the power reverse and see what signals are given. With the manual reverse you are in the cab and have to wait until you make your movement with the lever before you can see anything or look out. As to the relative safety of power reverse and manual reverse, you are not scared to death all the time with power reverse for fear the lever is going to hit you on the foot, or somewhere, when you are running along. You have got your foot outside the reverse or quadrant (T. 545–546).

127 CROSS-EXAMINATION

I have never asked the company to install foot braces, and I don't know whether the men on my division have asked or not. We generally get a block ourselves and put it right at the front end of the quadrant. I never tried it myself. I needed more leverage. I wanted to get my leg up over so I could use all of my power. I wanted to get something higher up than a brace on the floor, because the lever is hard to handle on the Atlantic type. As to whether there is any mechanical reason why a brace could not be placed higher up I do not think it could, it would be in the road. If that brace were up on the boiler it would interfere. There is hardly room for it outside of the boiler between that and the edge of the cab. The air pipes and the brake valve take up a lot of room. On some engines you can't get your feet between the seat box and the air pipe. The air valve and brake valve is ahead of the seat about the level of your vest as you are sitting on the seat. It is pretty close to the seat box. The brake valve is supported by a bracket fastened on the boiler. There is a space between the boiler and the side of the cab. On some engines I can get by and some of them I cannot; by that I mean I can get out of the front end of cab if I want to. If there was a foot brace down at the bottom it would not do me any good. I want more space to get the strength. As to whether you could put it any height you wanted to, as high as the brake valve in that space, it would then be in the road when you have to put the lever down. If it were put outside of the brake valve between the brake valve and cab side, I don't know whether that would help out or not (T. 546–551).

At the time of my accident, when I raised the dog out of the quadrant notches the lever went down in the corner and caught me,
and I think it was between the air pipes and the lever. That
128 was not the only time I was ever injured by the hand lever.

A good while ago I was injured, though not very bad. I had an engine that was pretty well worn and ready for the shop, and when running pretty fast the lever flew out of the notches and hit me in the heel. It did not break any bones and I stayed on the job. I never said anything about it. I must have had a foot over a little close to the lever, with my heel sticking over the front end of the

quadrant. I tried to keep my feet some place in the cab but there are so many pipes there you can't get your feet anywhere. There was no guard to keep my foot from getting in front of the quadrant. On other occasions the lever had gone down, but I never have been injured. I do not know how many times the lever has gotten out of the quadrant and gone to the corner. It has been a good many times. I just set the brakes and would slow the engine down and get the lever back. It would average at least once a year. I had to slow the engine down, I couldn't get the lever back any other way at high speed (T. 551–553).

I have been running the Atlantic type of engine weighing 101,500 pounds on drivers off and on for about 26 years. I have operated power a good deal lighter than that, but I have never had engines heavier than this 100,000-pound engine except to run a big engine occasionally (T. 553–554).

FRANK SMALL, a locomotive engineer formerly employed by the Maine Central Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Portland, Maine. I hired out on the Maine Central in 1873, wiping engines, and went to firing three years later, being promoted to engineer in 1883. I am 73 years old, and have had 44 years' experience as an engineer. I ran on the mountain division from Portland to St. Johnsbury, Vermont. I am not in service at the present time on account of an injury that took me out of the service (T. 556–557).

129 It was stipulated by and between counsel for complainants and defendants that the evidence to be introduced in this cause relating to the amount of money paid by the defendants to employees injured in connection with reverse-gear accidents, and hospital, doctors, and medical expense paid by the carriers in connection therewith, is limited to the purpose of showing the expense incurred in such accidents (T. 557–560).

Frank Small continued his testimony as follows:

When I was last working on the Maine Central I was running a ten-wheel engine weighing about 145,000 pounds on drivers, equipped with a manual reverse lever. I was injured by the reverse lever on that engine on April 15, 1927, between Cumberland Mills and South Windham. The number of the locomotive was 289. On that occasion the main driving journal broke and came up and struck the reach rod, throwing the lever into back gear and catching my leg against the back board. The broken parts struck the reach rod and threw the lever into back gear. We were travelling about 55 to 60 miles an hour. It broke my leg. Because of that injury I was laid up six weeks in splints, ten weeks in a cast, and had to have my legs massaged and baked ninety days. I have not been able to do any work since that time. I made a settlement with the company for the accident, going before a board of judges, and they allowed me $14,000.00, and paid all of the hospital bill, amounting to $750.00,

and also the X-ray pictures, amounting to $150.00 more. I settled with the doctors myself (T. 560–564).

CROSS-EXAMINATION

I had 56 years in service when I was injured, three years wiping engines, seven years firing, and the rest of the time running as an engineer. I do not know of any pension rights or retirement age on our road (T. 564–565).

130 The accident was caused by the breaking of the journal and the journal let the driving wheel down, throwing the wheel off. It stripped the rods on both sides of the locomotive. I saw a wheel on only one side go off the track and did not stop to see any more. When the rod struck that position it flew up and tore the tumbling shaft off the frame, and the lever went into back gear. The lever went back and forth I don't know how many times, but it hit me every time. The award of $14,000.00 was paid within twenty-four hours after the decision was made. In my 44 years' experience as an engineer about 75% of the time was spent on hand-reversed engines. No one else was hurt on the occasion when I was injured (T. 565–566).

OWEN HOWARD, a locomotive engineer employed by the Baltimore & Ohio Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Newark, Ohio. I hired out as a fireman in 1899 and was promoted to engineer in 1903. The territory where I run is between Newark and Sandusky and Newark and Benwood. I hold seniority rights to Cincinnati, and between Newark and Columbus, and also on the branches between Zanesville and Parkersburg, and Cumberland, and Lore City and Cumberland. My experience has been principally in through freight, with very little local freight and yard experience. In through freight service we have the Q–1s and the 1400s, which are 2–8–2 locomotives weighing 218,740 pounds on drivers, and are hand reversed. We also have the E–21–CA's, a 2–8–0 class, weighing 202,900 pounds on drivers, manually reversed. We also have the E–24s, which are a 2–8–0 class, weighing 173,000 pounds on drivers, two of them with air reverse, and the others with manual reverse, used on branch line locals. Then we have the E–22s, which are a 2–8–0 type weighing 158,350 pounds on

131 drivers, used in mine run and yard service. The last two classes I have described have Stephenson motion and slide valve, and manual reverse (T. 566–569).

The E–22's are a deckless engine and we have to sit alongside of the reverse bar, the bar being between us and the boiler. On the E–24's we sit at the rear end of the reverse bar and it is to the side and in front of us. The E–27's and Q–1's are a half deck

engine and the bar is between us and the deck. The handling of the bar varies at different times. Sometimes they are hard to operate, depending upon the weather and other conditions, and sometimes they handle so you can pull them over. When they handle hard I have seen them when it took all the strength I had, and I had to get some help. The fireman would help me. The only foot brace I have seen was when we would take a large monkey wrench on the E–24's and E–22's and attach that to the front end of the quadrant so we could put our foot against it. The purpose was to brace ourselves. I do that to take up all of the slack, so that when I release the latch I want to get rid of that jerk as much as I can. Using the monkey wrench as a foot brace, the amount of strength required to throw the engine over varies. At times I have seen it when it would take all you have, and other times it would not be so bad. You could get hold of it with both hands and pull it back (T. 569–572).

I have had the lever jerk in my hands when I was handling it using the foot brace. It jerks and gets away from you and will slap right over into the corner, and if you are not braced that way it would be liable to overbalance you and throw you over. I have been thrown into the corner and have been jerked up with them. That did not happen that I remember of when I was using the brace. I don't let them take me into the corner any more. I let loose of them and let it go. The cause of the lever jerking might be dry valves, the speed of the train, or a swing in the track. We had pretty bad
132 water last summer during the drought, and they used treated water. My experience with treated water is that it is more liable to raise the foam when you open the throttle. That goes down onto your valves and cylinders and gets them dry. I do not recall any difficulty with worn latches in the quadrant, or the quadrant being worn. The only foot brace I have ever seen are those made with the monkey wrench. I have had engines which had no monkey wrench or a foot brace of any kind. When I have attempted to reverse or hook up an engine which had no monkey wrench or any kind of a foot brace, I would put my foot against the brake valve or pipe or the boiler head, because if a jerk would come it is a good way to be braced, and it assists me by giving more leverage to pull on the bar. I cannot say whether I could hook up or reverse an engine without bracing myself in that way. Whenever I go to hook it up when the engine is in motion I always brace myself (T. 572–575).

The E–24 engines are 2–8–0 type weighing about 170,000 pounds on drivers, equipped with Stephenson motion and slide valve, while the E–27's are 2–8–0 type weighing 202,900 pounds equipped with Walscheart motion and piston valve. I would rather switch cars or handle the E–27 CA's which are 202,900 pounds on drivers, than I would with the E–24's with 173,000 pounds on drivers, because the last class has piston valves and Walscheart gear, and the bar sits in a handier place for me. With the Stephenson motion you have

to move or life the link in reversing the engine, and that is a heavy part. With the Walscheart motion you lift the link block. The link is made so that it does not raise or lower, and the link block is a light part (T. 575–577).

I was injured while operating a manual reverse bar on December 3, 1927, near New Concord, Ohio, on engine no. 4306,
133 which was a Q–1, 218,740 pounds on drivers. I was on a fast freight run going down Concord Hill, drifting with the main throttle shut off and the drifting valve open. As I neared the bottom of the hill there is a crossing and order block, and I was watching closely for them, and I smelled something getting hot and thought it might be my driver brake sticking. I was looking out, and I just reached over and shoved the independent brake valve to release the brake if it was sticking, which it was not. The reverse bar came right down and caught my hand on the brake valve. The reverse lever was hooked up probably half way up the quadrant. I reached over towards the boiler head to get the brake valve, and the reverse bar was sitting up alongside of me, and it jumped out of the quadrant and came down and caught my hand. It came in kind of under my arm. It bruised my hand pretty badly, and it turned black and blue. I put on the brake and slowed up the train. The fireman came over and assisted me and hooked the engine up. I went on to Cambridge, about 12 miles. I sent a message to the officials, and as there was no one to take my place and I did not want to delay the train, I went on until we got another engineer. My hand swelled up so I could not use it much, and I got the fireman to help me hook up the engine when I ran my train on. I was off duty 10 days because of that injury. The quadrant had become loose at the front end and allowed the lever to drop down. There was 3/8 of an inch clearance between the bar and the handle of the brake valve, and about two inches clearance between the bar and the boiler head. I was reaching over after the independent brake valve when the accident occurred. The end of the handle was just up close to the brake valve. I shoved in there but that made my hand come out past the lines of the bar (T. 577–581).

134 CROSS-EXAMINATION

The independent brake handle is about six inches long. We shove it around to the left in order to release, and when it is at the extreme left end of the swing that is when the end of the handle comes closest to the reverse lever. I had my hand out past the end of the handle just enough so that the lever caught my hand. The thing that caused the lever to come forward was the fact that the front end of the quadrant was loose. I had not noticed that on this day before the accident. We run in pool service and don't have regular engines. I do not know whether the quadrant was found to have been loose on previous occasions or not (T. 581–584).

The Walscheart gear has the effect of making the reverse lever handle easier than the Stephenson gear. The later type of our engines have been equipped with Walscheart gear. To the best of my recollection I never saw any foot brace which looked like it had been installed as part of the locomotive rather than an improvised one. I have never heard of any request of the men on our division for a foot brace. A permanent foot brace put up in the most convenient place might be of assistance in bracing myself on some classes of engines, but on the older classes I don't think it would be practicable on account of the room. If you had a nice foot brace on the boiler head it might be a good thing. There wouldn't be so much chance for your foot to slip. The danger of putting your foot on the boiler head is that it may slip down and get into a dangerous place. I have never heard of that happening, but there might be such a thing. In a way it might be a safer device, but so far as making the engines handle any easier I don't think a foot brace would have anything to do with it. You can get ease of handling from the boiler head as well as from a foot brace, but on some
135 of our engines you cannot put your foot on the boiler head because the reverse bar is ahead of the boiler head. That is on the E–24s and 1900s—the deckless engines (T. 584–587).

When the lever gets away from me it goes to the extreme front part of the quadrant pulling away from me. If it happens when I am backing up it would go to the back corner. We have very little backing up to do, and I don't know that I have ever had that happen backing up. When we are running ahead it is the speed of the train and the weight of the valve gear which makes it go forward to the corner, and I would think the same thing would cause it to go to the back corner when we are backing up. The occasions when the reverse lever gets away from me, and has gone to the forward corner is when the valves are dry or some part of the valve mechanism is dry, or there is some defective condition there. There would be something that might knock you off your balance, and it would get away from you. On the occasions when it gets away from me after I unlatch, if it has a much greater pull than normally, and when it gets beyond my strength I don't go with it. It is my custom to always brace myself even for a normal operation (T. 587–589).

I have been an engineer for about 27 years and I expect that 30 days is all I have ever operated a power-reversed engine. The rest of the time was with manual reverse. I expect I have had two or three years, experience on 2–8–0 engines weighing 158,350 pounds that I described. That is the lightest type of engine we have, and I have not had any considerable experience on engines any lighter (T. 589–590).

The engine on which I was injured was running between 35 and 40 miles an hour at the time. It was a half-deck engine and we had a drop seat. I did not have opportunity to inspect it before we went out on that run. There was no monkey wrench on the

quadrant to be used as a brace because we can't get at
136 this quadrant. At the time I reached over for the independent brake valve I did not know that the front end of the quadrant was loose. After I got back home I asked what caused it and I was told that it was loose. My body would have come in the line of the lever if I had reached for the independent brake valve with my right hand. As to whether I could have reached it with my left hand, as I undertook to do, without curving my hand around so as to come in line with the lever. I made a normal move on it like we always do. I just reached it to shove it ahead. My mind was on the crossing and order block. As to whether I could have kept my hand out of the way if I had known the lever was going to get me, I would have put my fingers in and pushed it, or I might have gotten a stick or a monkey wrench. I could have reached in this way and shoved it around (T. 590–593).

REDIRECT EXAMINATION

As to whether a foot brace that was constructed as a part of the engine designed in connection with the quadrant would eliminate the danger of hooking up the lever or reversing an engine, there is just one thing I can see that would eliminate it. We put our foot up against the boiler head and if we had a brace there that was so designed at the right place that my foot would not slip, so there would not be any chance of your foot slipping off of it, that would be the only advantage. If would have to keep your foot from slipping. On the boiler head you might have grease on your shoe or something like that and your foot might possibly slip. That is the only thing I know that would help any (T. 593–594).

J. H. Austin, a locomotive engineer employed by the Savannah and Atlanta Railroad, was sworn and testified as follows:

137 DIRECT EXAMINATION

I live at Savannah, Georgia. I began firing a locomotive in 1902 and was promoted to engineer in 1907, on the Frisco Railroad. I was employed by the Savannah and Atlanta in 1914, and am running from Savannah to Camak on local freight. We have no passenger trains, they are just mixed trains, and freight and yard engines. We have eight ten-wheeled engines weighing from 105,000 to 130,000 pounds on drivers, equipped with manual reverse, two of which have Stephenson motion and slide valves, and six have Walscheart motion and slide valves. We also have five 2–8–2 locomotives weighing about 170,000 pounds on drivers, power reversed, and two more of the same type a little heavier, also equipped with power gear (T. 594–596).

The clearance around the manual lever on the two larger sizes of the ten-wheel engines that have the Stephenson motion is not much.

The lever will not come by the seat box without hitting my side. I cannot reverse it to back motion while sitting with both feet in front. I have to get up, and usually straddle the lever in order to reverse it in switching. I sit astraddle of the lever with my left foot over on the left side of the quadrant, and the right foot on the right side of the quadrant, and I bring the lever back, you might say, between my legs, and sit there and look out, looking behind over my left shoulder if I want to look toward the rear. Sitting in that position the lever comes pretty close. I am a pretty good-sized man and haven't any room to spare. A good while ago we had a foot rest the full size of your foot nailed down to the floor. I do not believe we have them now, and I am not running these little engines except in an emergency at the present time. When I reversed the engine, or hooked up the lever, it was usually my practice to put my foot on the injector pipe to give me a better brace. My right foot would be about 30 to 36 inches above the floor and I could get hold and come back with the lever that way. That was when I wanted to
138 reverse the engine in back motion. If I want to hook up the engine I sometimes get the injector pipe, but usually get astraddle of the lever and put my left foot on the boiler head, and drop it down that way. The purpose of putting my foot on the boiler head is to get a brace and keep from being thrown in the corner. I have been jerked pretty hard. I don't know whether the lever ever got me clear down or not. I have been jerked when I was handling the lever with my feet braced as I described. It jerks every time regardless of how you are braced. If I were not braced I could probably pull the lever up to center, but I would have to get in front of it to push it back if I were standing still. When moving I couldn't do that. When I am braced in the way I have described it takes just about all the strength I have sometimes to reverse the engine, other times it might not be so hard. I am describing the 130,000 pounds ten-wheel engines. As to the 105,000-pound engines, sometimes they handle pretty easily and sometimes hard. When they handle hard I have to brace myself the same as on other engines. On these engines the lever will jerk at times. I have had to have assistance in reversing the ten-wheel engines. If I start off and cannot move my train, sometimes the fireman helps me move the lever back so I can take slack with steam in the cylinders. I have experienced the lever jumping out of the quadrant. It goes to the corner and it goes to the corner "right now." There are several things that will cause the lever to go to the corner. Sometimes there is apparently no cause and it will get away from you. Things may look as though they are all right but the reverse lever will get out of the quadrant and go to the corner. As to what I have observed will cause the lever to go to the corner, dry valves, worn parts of the link motion, and reversing gear, worn notches in the quadrant, worn latch, improperly adjusted latch spring, are some of the causes. When we
239 have these conditions in the latch spring and quadrant the lever is likely to jump out of the quadrant. I usually run along

holding the latch but sometimes a man has something else to do and he cannot always do that. The purpose of holding my hand on the latch is to keep the dog down in the quadrant. We have occasion to take slack lots of times. If you have to take slack you have to reverse your engine every time. You cannot make this a fast movement if the lever works very hard. Sometimes you do not want very much slack, and if you give it too much slack the slack of the whole train will run out and you will be as bad off as you were before. Sometimes if you get one or two good exhausts it will do. In that movement when you feel your engine start back you have to be quick and throw the lever ahead, and we have to be pretty husky to do it right when it ought to be done (T. 596–602).

About two-thirds of my territory is hilly. Some of the hills are half a mile long, and some have a five- or six-percent grade. Most of the time we can't work steam going down. We shut off and drift and get almost to the bottom of the hill and then we go after the engine. In that way, drifting, you drop the lever down half a stroke or wherever you think is the proper place. Then when you start up the hill you have to hook it up. You have to hook the engine up and drop it down right along. In yard service you are switching almost continually. Our yard extends out about 12 or 14 miles and that gives us a little running there without switching. We have frequent back-up movements, and sometimes we have occasion to hook up the lever while running in backward position. I have never had the lever jump out of the quadrant running in backward motion (T. 602–604).

I was injured in operating a manual lever on a switch engine while running in backward motion. The accident occurred on December 18, 1929, seven miles out of Savannah. The number of the
140 engine was no. 114, and it weighs about 110,000 or 112,000 pounds on drivers. We had just finished switching cars and had started to come back to town. I was in the back motion and was sitting facing the train. As the engine picked up speed I reached with my right hand and unlatched the lever, and took my left hand and caught hold of the lever to push it up towards center. As I did that the lever jumped back and caught my left hand and elbow against the back of the cab. I had unlatched the lever with my right hand and got my left behind it. I had both hands on the lever and was pushing up to bring it to center so as to get a short cut off, and the lever jumped back and caught my hand and elbow against the cab straining my wrist. The lever jumped back. It did not go clear to the rear corner on account of my arm. I was off duty 19 or 20 days on that account. The company paid me about $135.00 or $140.00 on this account (T. 604–607).

On another occasion, with the same engine, I was running up a hill with a pretty good train, working the engine hard. I had my hand on the latch holding it in the quadrant as I always did. I took my hand off the latch for some reason, and the lever jumped out of

the quadrant and went to the corner, breaking a valve yoke. As the lever went into the corner it increased the steam pressure in the valve chamber, I suppose, and that snapped it on one side. They sent me another engine. I am not sure whether there was a stop in the quadrant or not. Some of those engines have a stud through the quadrant which extends out an inch on each side to be used as a stop (T. 607–608).

I have had experience on manually reversed engines weighing not more than 80,000 or 85,000 pounds on drivers. Sometimes these levers handle heavier than on a bigger engine. We would shut off to drift down a hill, and ordinarily drop the lever down. The engines were so hard to handle that we would leave the lever
141 up in working position. The purpose of shortening the shut-off is to save coal, and make your engine run faster. In my experience you do save steam and coal when you are running in a short cut-off as compared to wide open. I am not sure whether I have had the lever on these 80,000-pound engines jump out of the quadrant or not. I do know they were hard to hook up and drop down (T. 608–610).

I have had experience with power reverse and would say, as to the comparison between the amount of strength required to operate power-reverse gear and manual gear, that it does not take any strength to handle power reverse, and it takes all of your strength to handle manual reverse. I have always been able to reverse the engine with power reverse. With manual reverse I have gotten the lever over if it has to be put over, but sometimes I would have to be assisted by the fireman. As to the length of time it would take me to throw over the two types of gears, you could reverse the power gears, I suppose, twice while you were trying to reverse the manual lever. You have to get into a certain position before you can start to reverse the manual reverse, and you don't have to get ready to reverse a power gear. All you do is to get hold of it with your hand, and it is just a movement of your hand. As to the relative safety of the two gears, I do not consider there is any danger at all with the power reverse. I do not see how anyone could get hurt unless the engine would turn over and stick that little reverse lever into him. As to maintaining the cut-off with the power-reverse engine, you can regulate the cut-off at any speed under all circumstances without any trouble whatever. We have had some engines that creep. A man came from the factory and worked on them, and they were a little better than before, and perhaps they were not taken care of like they should have been. They have been there since 1919, I believe, and they may not have been what they ought to have been. When the power reverse creeps
142 I do not see any danger at all in that. It just drops your links down and increases your valve travel, and you run along that way, and you would think she had gone down half-way, and then after running a little way it would jump back the other

way. Sometimes it would jump so far back it would cut out the valve and you would have to keep pushing the lever ahead. But that is just an expense to the company; there wasn't any danger in it to the men. There would be no danger in reversing the engine while going ahead. One time I was going down a hill into a crossing and saw a train standing down there, and I slowed down the best I could with the brakes but didn't know whether I was going to stop. I opened the sand pipe, went back inside, opened the cylinder cocks, and reversed the engine. I wasn't running more than fifteen miles an hour at the time. I don't say it is a good idea to do that unless it is in emergency. That is the only time I have ever reversed one of those engines that way. With power reverse gear, in case any part of the link motion would break, I don't see how there could be any danger to me from the lever in the cab. The whole lever is small and is fastened in such a position that it couldn't come off. The reach rod, or something like that, would break off under the running board before it could get up to the top of the running board with the parts that would hurt you, if it would happen to come loose (T. 610–613).

CROSS-EXAMINATION

In the five years I ran on the Frisco I had hand-reversed engines, and the first five years I was with the Savannah & Atlanta was entirely with hand-reversed engines. Since then I have spent about three years with manually reversed engines, and seven years with power-reversed engines. On the larger ten-wheelers, weighing 130,000 pounds on drivers, the levers will not come back by me. On the smallest of the ten-wheel engines, when you have the lever hooked up where you want to work the engine, it is just about to the back end of the boiler. I suppose the company put on the foot brace which I described. I did not use it, although it was placed about as well as I considered it could be, but it did not suit me as well as other places I could find to put my foot. I believe the smaller ten-wheel engines handle easier than the big ten-wheelers, because the larger ones do heavier and faster work, trying to get out of Port Wentworth with a train. When we got out of there with about twelve loads and get over the hill, we are just barely moving, and the engine is in the corner. The others we don't work that way, and there may be a difference. We have less difficulty with the smaller ones jerking than the large ones. The question of the particular class of service in which an engine is used will have a great deal to do with the difficulty of handling the lever. If you are working the engine hard, really harder than it seems you ought to, if you are giving it more steam, and the steam is following your valve further, I believe it is worse than it would be if you had it hooked up. These engines are taxed to their utmost to get out of there with twelve or thirteen loads (T. 613–617).

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On the occasion when I was injured I was backing up and sitting facing to the front of the locomotive, and when I looked out of the window I looked around on my right shoulder. When I went to hook up the engine, which was in backward motion, I turned around kind of facing the lever. My feet were in front. I caught the latch with my right hand and unlatched it, and caught behind it with my left hand to kind of help it up to center, and it jerked. It was a kind of awkward position I was in. I was trying to raise myself. There wasn't room for me to face in the direction I was going, that is, facing the rear of the engine with the quadrant and lever
144 on my right side. Our seat box is in the extreme corner of the cab. When I was switching I would sit astraddle of the seat box, and if I threw the lever in the back corner it would touch my leg. I don't mean it would mash my leg, but it would touch it lightly. Ordinarily I would be sitting facing the lever. On the occasion when the lever jumped and went into the corner and the valve yoke broke, the lever went to the forward corner and stayed there. The valve yoke is connected to the valve stem and is a kind of square hook or cage around the valve permitting its movement. The lever jumped out of the quadrant and went to the corner and stayed there. I wasn't going more than fifteen miles an hour up that hill. I don't know what caused the valve yokes to break. At the time the engine was not lame. It all might have happened at the same time, and it might have been an old break in the yoke. If the yoke gave way suddenly it might have caused the lever to have kicked. It may be I am mistaken about this, I thought it was the other way (T. 617–621).

I have had considerable experience in yard service off and on. I was in yard service at the time of my injury, and as I say we had a long distance to go, but so far as switching is concerned, I don't believe I have had that experience of the lever jumping out of the quadrant. In yard service we usually work the engine full stroke either way we go, but if you have any distance to go you hook your engine back. If the lever is in full gear ahead it could hardly jump out of the quadrant because it would be in the corner already. As to whether it is a fact that if the lever jumps out of the quadrant it always goes in the direction of the locomotive, that does not necessarily follow. Sometimes it jumps back and forth. I have experienced in switching service occasions where we would probably go not more than half a mile and have the lever in the back corner, and when we would be going along the lever would creep. It
145 would come out of the quadrant and creep like it wanted to go ahead, that is, come up maybe two or three notches towards the center. I don't believe I have had occasions where the lever went to the corner while backing up. When it went back and forth I didn't know whether anything was broken, and I don't know just why it does it, but I have seen it do that. It has not gone past the center, but it might be a counter-balance spring out of adjustment.

Sometimes you have a counter-balance spring of such a tension that going ahead you have to push the reverse lever towards the forward corner. This happened several years ago, but I recall it happening several times (T. 621–624).

We have Alco and Ragonett power reverse. I have not run the latest ones we have gotten. I noticed the creeping on the first ones we got, which were Alcos. It is on the old engine. When they creep they would creep down and you could tell it by the heavy exhaust. They would run that way maybe a little while, and then they would jump back. The lever would not move in the notches at all. The valve just goes ahead and works that way for a little way, and then it will creep back. Sometimes it creeps so far back it cuts the engine out, and then, perhaps, you have to throw it a notch or two ahead. By cutting the engine out I mean that it reverses the engine, so to speak. I had that happen at 25 or 30 miles an hour in freight service, under different conditions. There are two of these engines that creep every time I run them, but the engine I am running now does not creep. It is only when I get somebody else's engine. This experience with the creeping engine was over a period of two or three years. They had the man from the factory down to see if he could not stop the creeping, but I have not run those engines since. They say he did some good (T. 624–627).

In ordinary switching I will sit on the seat box at the extreme back corner of the cab. The seat box has a little back there
146 and is right up against the cab. I sit with my left foot on the left side of the quadrant and my right foot on the right side of the quadrant. I am facing towards the center of the locomotive, usually kind of diagonally across, and I look back for signals by leaning against the back of the cab, my back being against the lower part of the window sash. From that position I can look either forwards or backwards out of the window. To operate the lever I usually get up. I raise up when I start to reverse the engine, bring it back, and sit right down, leaving my feet in the same place on the floor. The lever moves between my legs but some against this leg. This leg [indicating] is sticking out kind of straight ahead, and this one [indicating] is this way. It is a kind of an L-shape. I try to keep my legs out of the way. When in back motion when the lever is in full stroke back, it touches my leg but it does not touch it to hurt me. I have found it to be the most convenient way for me to handle the lever. Each engineer has his individual preference, and I see some who do not sit like I do. This is the position I take when I work it behind me. When the work is in front, sometimes to rest myself I sit with both feet together as near as possible. If I get over a switch, then I have to get up and catch the lever. The lever will not pass me sitting there. The quadrant is too close to the cab to give me clearance. The quadrant will just pass, and sometimes when the cushion is kind of mashed out on top the reverse lever rubs along that cushion. The cushion on the seat box is twenty inches

wide, and I fill up that cushion pretty well. When I am switching forward and do not have to reverse the engine I am sitting on my seat facing forward. In making or breaking up a train, I estimate that I have to reverse the engine from one end of the quadrant to another, one movement every minute. Sometimes I make two or three kicks before I get over a switch. It is according to the grade you have and how the cars roll. These are conditions under
147 which I have to move the lever the most. There are sometimes when you do not have to handle the lever from one extreme to the other; for instance, if you have to go from one part of the yard to another. We have fourteen miles from Savannah to our industries at Port Wentworth, but we do not go there without stopping, as we pick up cars as we go along, and probably have to make a few switches and classify our cars before we start over the hill. Sometimes it takes an hour and a half with the work, and it depends upon the work we have to do. We have two or three yards to pick up cars. There are times when the engine stands idle for a few minutes, and when the train is being marked up. The yard foreman may want to mark up the train and I stand until he gets ready to see what he has to do. Our work is directed from the dispatcher's office. There may be times when I will not see the yard foreman for an hour, but then I am working right on with the remainder of the switch crew. Sometimes, if we catch up with our work, we might wait five or ten minutes for a transfer from other railroads to come. They may not be right on time, but we usually have something to do. We are not idle very much. We used to be, but we are not any more. We have work waiting for us all of the time. Sometimes there may be a little delay (T. 627–636).

In placing my feet to brace myself, I try to put them in a place where they will be to the most advantage in getting the lever back, and where they are out of the way. I usually put my foot on the injector pipe if I am going to reverse the engine in back motion. That is straight ahead next to the boiler, but in front of the reverse lever. The lever could not catch my foot up there. When I spoke of holding my hand on the latch of a manual bar I meant the latch handle that is near the top of the lever, used in raising the dog out of the quadrant. The latch handle isn't in such a bad position, but it doesn't feel altogether good when you have hold of it. It
148 has kind of a vibration and gives you a shock all of the way through. Sometimes I would put my arm up there to hold it when my hand would get tired, and my hand and arms when I would be through work would be pretty tired and I would feel it. I am 52 years old. It was stated for the record that witness Howard was 53 years old (T. 636–638).

H. G. WILLIAMS, a locomotive engineer employed by the Chicago & Northwestern Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live in Chicago, Illinois, and am 55 years old. I have been employed by the Northwestern 28 years as an engineer. I am engaged in switching and transfer work. In that service I use a class Z engine, a 2–8–0 type, a little more than 200,000 pounds on drivers, at present equipped with power reverse, formerly manually operated. I have operated them both when they were manually and power reversed. None of those engines that I know of in service at the present time are manually reversed. We have the M–2s, M–3s, and M–4s equipped with power reverse, the M–2s being 170,000 pounds and the M–3s and M–4s 200,000 pounds on drivers. The M class are manually reversed, as the M–1s. I have had experience on the Ms and M–1s, the M–1s being a six-wheel engine weighing 170,000 pounds on drivers. The Ms have Stephenson motion. Some of the M–1's have Stephenson motion but most have Baker motion. Their weight on drivers runs something between 160,000 and 170,000 pounds (T. 638–642).

With reference to the amount of strength required in reversing the M's and M–1's which have Stephenson gear, after they are broken in they handle fairly well. Those with the Baker gear always
149 handle hard and very irregular. They are very tiresome and if you are not watching yourself you are liable to be injured by them. My habit, in handling the M–1's with the Baker gear in switching service, was, when I would get a signal, to apply my brake, catch my lever before the engine would stop, and pull it over. There are certain points with the Baker gear that are very easy, even with a new engine. At other times you can hardly get them over with both hands. The difficulty was caused by the change of the angularity of the gear. There are many different angles and a couple of angle levers, and different positions of those which would throw the weight from one side to the other of the lever. We did not have a foot brace on those engines. When I wanted to throw the lever backwards I generally threw my foot against the injector pipe, and in reversing the lever backward and forward used to brace myself against the seat box. We had a seat box and a drop seat. I braced myself to give myself more power. With my feet braced in that position there is always a danger with the hand lever. I refer to straining yourself in twisting because you are always in a peculiar position trying to throw the lever over, and it is harder than lifting a load because you cannot get at it (T. 642–643).

It was a common thing for the lever to jump out of the quadrant. It is common when you have your engine hooked up for a lever to jump and go down to the corner if it is going in forward motion. I have never experienced it flying out going back. If I had ahold of it when it flew out I would get a good jerk. I have been jerked pretty severely. As to the extent to which I have been jerked, I would be thrown up against the boiler head, but not with the switch engines because you have the lever right alongside the boiler. I refer

to transfer service with the Z engine, as to these occasions when I am thrown up against the boiler. The lever may jump out of the quadrant due to several reasons; a badly worn latch, latch
150 spring too weak, dry valve, or lost motion. On the Baker gear I have noticed the latch and quadrant wear very fast, and it is hard on the lever. As to why this is, I do not know unless it is because there are good many more bearings in a Baker gear than on a Stephenson or Walscheart (T. 643–645).

I was injured in operating a manual reverse lever in 1927, in transfer service, on engine no. 1893, a Z-type engine, weighing about 200,000 pounds on drivers. It was manually reversed at that time. The accident occurred at the 40th Street yards in Chicago. On that type of engine the clearance of the lever from the seat box was about four inches or probably a little more. The lever passed back of the arch brace of the cab for about four or five inches, and there was just enough clearance between the lever and the brace to get your hand in there at the rear of the cab. We were pulling in on a track and a switch engine came up, and they wanted me to back up so it could get in with the way car. As I was going ahead I applied the brake and caught hold of the lever, and as I did that it flew back, catching my arm and spraining my wrist. It just threw me on over the lever out onto the deck, and caught my left arm against the angle brace at the arch of the cab, which was about a 3 x 3 angle arm with a sharp edge pointed toward the inside of the cab. That was the point where the lever passed. It was behind and to the left of the position I was in. It took me from the position where I was when I was struck right over the seat box and over the lever with my feet down on the deck, and pulled me across the quadrant. I sprained my wrist and bruised the bone and was off duty on account of that twelve days. I don't know what caused the lever to jerk back (T. 645–648).

I was injured with the manual reverse lever on another occasion about six years ago in the same service, with the same class of engine on engine no. 1880. We were putting our train away in the yard, and had shoved down one track and made the cut, and I threw
151 the engine over and pulled the lever up. When we were to shove down the next track I went to throw the engine over to start it in backward motion, starting with the lever in forward motion. I put it in backward motion and pulled so hard at a certain point that when I went to release my grip on the latch I couldn't hold the lever, and it threw me back. I was standing right in front of the lever and then trying to shove it down, and it kind of wrenched me and caused a rupture. I did not have the rupture operated on. At the present time I have considerable effect from the accident, and I cannot use a manually operated engine any more. It causes pains around, in, and above my rupture. For the last three or four years I have not had anything but power reverse (T. 648–649).

I have no difficulty whatever in reversing an engine with power reverse. I have used the Alco and Barco gears. I did not lose any time from the last accident. It happened on a Saturday, and I went to the doctor on Monday and got a truss and have worn it since. The majority of the class Z engines are now power reverse. A few of them I think came from the factory with the power equipment on it, but I am not sure. It takes about 10 percent of the power or labor to operate a power reverse that it did with the manual reverse, and you can operate the power gear easily and work it either backward or forward and keep your eyes on the men working on the ground at all times. With manual reverse you cannot keep a lookout and your eyes on the men on the ground. You have to get your head in the cab to reverse the engine. As to whether that has any practical effect upon my ability to perform my duties I will say that it does not exactly, but still they may be giving you a signal. If they are giving you a back-up signal and you throw your lever over, and about that time they see something and give a stop signal, it may cause damage or injury to some person. I came near getting a switchman that way one time. We had coupled on to our
152 train and had some cars to cut out, and as I coupled on to the train the switchman gave a signal to go ahead. I had to reach in and throw my lever over, and while I was doing that he gave me a stop signal which I did not see, and he went in between the cars. When I moved the cars he jumped out and was sore. There was no damage done (T. 649–651).

As to the comparative length of time it takes to reverse an engine with power and manual reverse, I would not say there is any difference if the hand reverse is working easy; but if it is not working, then, of course, it takes quite a bit more time. I have never had any difficulty with the power reverse becoming totally inoperative. I have had some that would creep. There is no danger to me in the power reverse creeping. If it creeps, the lever is stationary and the creeping is all done in the cylinder. That is caused by the cylinder packing. I do not know from my own experience whether creeping was caused by the thrush plates. I asked what the trouble was, and the road foreman told me that. That is what I reported, but I don't know what they found. The trouble was overcome (T. 651–653).

CROSS-EXAMINATION

The company had to work on the power gears frequently from time to time to try to overcome creeping when they first got the gears, but now of course they know what is wrong. With Alcos the cylinder packing is made of a fiber packing or a rubber piece, and when they get worn badly they start to creeping; but all they need to do is to put in a new packing and it is all right. I reported creeping. I haven't had any trouble with the power reverse in two or three years. I have used both Alco and Barco in the last two or three years. It is difficult to say exactly how much the gears did creep,

when I had experience with creeping, because when you are
153 running at a high rate of speed they will start jerking, and I judge the piston probably moves three inches either way; that is, the air piston in the cylinder. The piston and tumbling shaft and the valve gear would do the same thing. The control lever in the cab would not be jumping back and forth, and you could not tell from its action that there was anything wrong, but you tell that by working of the engine. This was in transfer service, where I have run as high as 60 miles an hour between Kedzie Avenue and Proviso yards. Dry valves may have had some effect, such as a tendency to make it creep worse. Of course, what causes it to creep is that the pressure in the air cylinder is not equalized, and when the power goes on one side or pulls on one side the piston will work with it, and then back the other way. When the gear was creeping you could not maintain any fixed cut-off on the locomotive. The only way you would overcome that would be to drop your engine down and give it a longer cut-off, and that would stop it. You would have to leave it down there or it would creep again, and that uses more coal and water (T. 653–656).

On the Z engine where I hurt my arm and wrist there was about three inches clearance between the cab and lever, where the lever passed the back board of the cab; that is, the upper end of the lever in the extreme rear position came that close to the back board for a short distance. The extreme upper end of the lever would probably get back five inches past the back board. This was a steel cab with an angle iron clear around the arch. My left elbow and left arm were in such a position that they were caught on the edge of that brace. I was sitting in a natural position on the seat going forward, and they gave me a signal to stop and back up. This fellow called to me to back up and let his engine in first. When I got hold of the lever,
just stopping naturally, as soon as it loosened up it flew back
154 and caught my arm. I didn't have time to get it out. After I lifted the latch there was pressure on the lever that carried it right to the rear. It was latched probably two-thirds down the quadrant before I lifted the latch towards forward motion. I had not gotten the lever past center when the pressure came that carried it on back to the rear corner. I lifted the latch and gave a pull, and as I did that it flew right back. After it got over center it kicked back and exerted the force of the cylinder. I made a report of the matter, but did not call any special attention to the lack of clearance because they put the engine in the shop about a week after that, and put power reverse on it. I have nothing specific in mind as to any defects in connection with that accident, except the characteristics of that kind of a valve gear (T. 656–660).

As to whether if, instead of remaining seated on my seat box when I unlatched the lever to throw it into reverse, I had stood up and gotten myself into a position in which I could have let the lever back and kept my hand and arm in the clear of the angle iron, I then would not have been injured, I would answer that you are

liable to get injured in any position. There is no way to stand up on those engines and handle the reverse lever. You have to handle the lever sitting down or get on your knees on the seat box. My custom is to sit on the seat box and do it from there. That was true when these engines were hand operated. The seat box is right alongside the lever. There is no place to stand unless you would get up and get behind the lever and shove it, and you have to move the lever half way up before you can do that. In working the lever from the center toward the front end of the quadrant you cannot stand up and do that. The seat box is about twenty-four inches long, the quadrant about thirty inches long. The back end of the quadrant is about even with the end of the seat box, so that the entire quadrant is practically along the side of the seat box.

155 It is my observation that the engineers operating these engines with hand reverse generally remained seated on the seat box while they did so. I don't know how else they would handle this engine. This is not the only time I have reversed the engine to back position. I managed to keep from getting hurt every time I threw it back because it did not slide back on me every time. There is just about room enough for your hand, and you can shove it back half way and then get in front of it and shove it back. I pull it up from center, and then change positions, get in front of it, and shove it down. This is the only time when operating this engine with a hand lever that I had it jerk so hard that I was unable to change my position. I have not been running that engine with manual reverse for a year or so when this happened. I have been running the Z's with power reverse, and there might be something to the fact that I was somewhat out of practice handling the manual lever. I have handled the Z engines ever since they put them in service. They were in service twelve years with manual gears. I have been running power reverse off and on for six years before I got the hand reversed engine on which I was injured, and I had gotten hand reversed engines from time to time during that period (T. 660–665).

On the occasion when I was ruptured, I shoved the lever back about half way and then got in front of it. That was the only way that I could get it down to the corner. When I tried to release my grip on the latch to hold it, the lever flew back before I could do that and wrenched me, causing the rupture. The flying back was just a steady pull of the lever towards me. It was probably caused by badly counter-balanced spring. That would not do it in all positions but only certain positions of the engine. The engine was standing still. I did very little switching with a Z engine, but when I was switching I generally sat astraddle of the seat box, with one foot up on the seat box and the other against the boiler. I would put my head

156 back and look over my left shoulder to get signals from the rear, and turn around and sit straight in working ahead. In backing up we had to straddle the lever. With reference to the time when I got a signal from the switchman and then reversed the engine

and started to go forward, and in the meantime he had given me another signal which I did not see, it is not my custom to look out again after reversing the engine before I pull the throttle when I am pulling ahead. If I was backing up I would. I thought he did not get the coupling, but he had the coupling and jumped in between the cars which he should not have done until he was sure I saw the signal. Ordinarily he should wait until he saw I observed the signal, but we overlook lots of little things like that in day's work. That is the only instance I have in mind where I thought the manual lever might have caused any trouble with the lookout (T. 665–668).

I have been an engineer 29 years, all but part of a year on the Northwestern. In the last two or three years I have used power reverse exclusively. Prior to that time, and since our company first installed power reverse, I handled both power and manual levers about equally. We first got power reverse gears before the war, and got more of them during the war, and right afterwards they equipped all our freight engines, so we are about 95% or better equipped with power reverse at the present time. I suppose that about 20 out of my 29 years has been spent with manual reverse. Most of the M's and M–1's have been scrapped in recent years. To my knowledge there are none left in service at the Chicago terminal. I consider that the Northwestern have proceeded to equip their locomotives with power reverse gears with reasonable speed with respect to the part of the road of which I have knowledge. I dare say 98% of these locomotives are equipped with power reverse. It is about ten years since they first started applying power gears to locomotives used at the terminal (T. 668–673).

157 ARTHUR R. DOMINI, a locomotive engineer employed by the Chicago & Northwestern Railroad, was sworn, and testified as follows:

DIRECT EXAMINATION

I live at Madison, Wisconsin. I am firing at present, but was promoted to engineer in 1917, and have had experience in yard and road freight service. Before I was promoted to engineer I had experience as a hostler. The hostler takes charge of the engine at the engine house, or a designated track, when the crew ties up. He puts on coal and water, or has the helper do it, and handles the engine. The hostler has the same duty in operating the reverse lever as the engineer in running the engine. When I was working as a fireman I have had experience operating the lever in assisting the engineer. At the present time I am on a freight run between Milwaukee and Madison. We have a 4–6–0 type of road engine, weighing about 140,000 pounds on drivers, equipped with manual lever; an 0–6–0 yard engine, weighing about 130,000 pounds on drivers; and in passenger service the E and E–1, a 4–6–2 type, weighing from 140,000 to 170,000. The 4–6–0 freight engines have Stephenson motion and

piston valves. Some of the 4–6–2 passenger engines have Baker, some Walscheart, and some Young valve motion (T. 673–676).

I have had experience in reversing the 4–6–0 and 0–6–0 type of engines. It requires all the strength I have most of the time on the road engines. The yard engines are not quite so large and are perhaps a little easier, but they require all the strength a person can stand for a day's work. In hostling service I handle all engines. The E–1, 4–6–2 type has a foot brace, and the others do not. On the ones which are not equipped with a foot brace, you brace your-
158 self either against the boiler head, air pipe, or some place where you can get a pretty good hold with your foot, in order to get purchase enough on the lever to get it over. When I am braced in that position I sometimes get the helper or fireman to assist me in getting the engine over (T. 676–677).

I was injured in reversing an engine with a manual reverse bar in 1916 at Madison, Wisconsin, on engine No. 2218, a 4–6–2 type, weighing about 140,000 pounds on drivers, when I was in hostling service. The engineer turned the engine over to me, and they cut off the train, and we cannot move the engine until it is released by the yard engine taking off the train. When they had the track clear I attempted to reverse the engine. I had gotten half way over and I was stuck. So I got a better hold and tried to finish the job, and got a sharp pain up the side which resulted in a rupture. I had to get the helper to help me finish pulling the lever clear back. The injury required an operation, and I was off duty 100 days. The company paid me $320.00, and my hospital and surgical expenses. I have no effects from that operation at the present time (T. 677–679).

I was injured on another occasion when handling a manual reverse bar, about 1919, on engine 818, a 4–6–0 type, weighing about 100,000 pounds on drivers, at Madison, Wisconsin. The engine was outside in the cold. I was instructed to get the engine off the spur track across the turntable. Everything was frozen up, and the helper and I tried to loosen it up with the lever. We first had to get the lever off center before we could move it. In doing so I sprained my back and they had to carry me home. I think I was off about a week (T. 679).

CROSS-EXAMINATION

That was on a S–2, 3 or 4 engine. I don't think the engine
159 had stood there over ten hours. It was wintertime and cold enough to freeze ice around the links and valve gear, and that was what caused the engine to handle hard. I can't just recall if there was ice on the links right now. An engine standing around gets frost and ice on it from leaks or steam from the cylinder or cylinder cock. I am 45 years old. The lever was on center when I went on the engine. I sprained my back in endeavoring to move it off center and to work it back and forth to loosen the engine off the rail. With a power gear I do not think I would have had to get down and thaw

it out. I did not try thawing it out on that occasion. I do not know whether that engine has been scrapped, but we have had several in that class in service at Madison now. They are not in regular service that I know of (T. 679–682).

When I spoke about the reverse lever working hard enough that I would be tired after a day's work I had reference to the yard engines, or any service in which you are handling the lever considerably during an eight-hour shift or day's work. As a hostler I have handled it enough to wear myself out quite a few times. In hostling you turn the lever over quite a few times, stopping the engine at the water tank, coal shed, cinder pit, and turntable, and possibly three or four times in the roundhouse for the mechanics before you get through with the operation of the one engine (T. 682–683).

On the occasion of my injury in 1916, which happened at the passenger station at Madison, I did not ascertain at that time what the cause of the lever working so hard was. I told the roundhouse foreman what I thought had happened to me and how it happened in reversing the engine. I did not have an opportunity afterwards to inspect the engine. I had gotten the lever from front motion to about center. That was about as far as I could get it without help. I tried it myself and hurt myself, and then got the helpers to help me finish the job. I strained myself before the helper came.
160 The engine was standing and there was no jerk on the lever. It was a mere straight pull-back. I could have reversed that engine with ice in the valve motion if it had been equipped with power reverse gear, without thawing it out. The helper and I together were able to reverse it, and the power reverse gear is stronger than the helper and me (T. 683–686).

ARTHUR R. RUDOLPH, a locomotive engineer, employed by the Chicago & Northwestern Railway, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Milwaukee, Wisconsin. I was hired as a fireman on the C. & N. W. in 1903 and promoted to engineer in 1907. My territory is the Wisconsin division from Chicago to Fon-du-lac, Chicago to Janesville, and adjoining divisions. I have had experience in all class of service. In passenger service at the present time we have the following manually reversed locomotives: Class E, a 4–6–2 type, weighing between 150,000 and 175,000 pounds on drivers; Class E–1, a 4–6–2 type, weighing 100,000 to 150,000 pounds on drivers, some R–1's, weighing 100,000 to 150,000 pounds on drivers, some R's weighing 121,000 pounds on drivers, these last two classes being 4–6–0 engines. We also have some Class D, 4–4–2 type locomotives weighing about 97,000 pounds on drivers. The R–1's and the R's are the predominating engines used in freight service. In switching service we have the M–1's and possibly a few M's, which are 0–6–0 type, weighing about 100,000 to 150,000 pounds on drivers. Some of all

of the engines I have described are equipped with Stephenson motion, except the E–1's, which are Baker-Pillod motion; the R engines have a slide valve. The following engines are equipped with power reverse gear: In passenger service our H engines weigh-
161 ing 288,000 pounds on drivers, and the E–2's weighing 175,000 pounds on drivers. In freight service the J's, a 2–8–2 type, weighing about 200,000 pounds on drivers. In switching service the M–2's, weighing 174,500 pounds on drivers. The Z engines are used some in switching service, and weight about 170,000 pounds on drivers (T. 686–691).

As to clearances around the lever on manually reversed engines, the lever on some of our E engines is pretty close to some of the appurtenances on the boiler. I should judge there is about a two-inch clearance, or possibly a little less in some instances. The quadrant is set to the front and left of the engineer. In backward motion the lever comes right up to your body as you sit down, and in forward motion it goes up in front a considerable way. On some of the M's and M–1's the levers are pretty close to the boiler. They are along the left side of the engineer, and to the front. On the R–1 the lever is to the left of you, and right along the seat box. On most of the R–1's you sit astraddle of the reverse lever in switching movement. You sit with your back toward the cab window so you can look out behind. When the lever is thrown in the back corner of the quadrant on a good many of these R–1's, you can't get your foot in the back of the cab. I got my foot pretty badly bruised one time when the lever caught it in that position. You have to be very careful that the lever doesn't get away from you going down in forward motion. If you happen to be bracing your foot there in hooking it up, if the lever happens to get away from you you are liable to get caught on some of the engines. You would be caught between the reverse lever and some of the piping (T. 691–693).

I have had experience in a suburban run from Chicago to Waukegan, in passenger service, making some sixteen or eighteen stops, in a distance of 39 miles. You will probably have to adjust the re-
162 verse lever four or five times between each stop and start, and I should judge you handle it a total of about eighty times on this trip, which takes an hour and a half. I have had experience on an express run from Milwaukee to Green Bay, and have to handle the lever from 50 to 100 times on that trip. Ordinarily we have ten stops without counting movements into the side tracks. We also have to stop and pick up cars at quite a few of those places, which requires reversing the engine two or three times each stop. The difference between 50 and 100 times depends upon the amount of switching or picking up of cars you have to do, and whether you miss any couplings or give the train slack in order to permit pulling the pin. In local freight service in the same territory we have to switch at nearly every station; I should judge from 15 minutes to two or three hours at some places. In such 15-minute period I would say we would handle the lever 15 or 20 times. When I speak of handling the lever I mean to move it in any way at all (T. 693–695).

In reversing the engine, in some instances the lever handles very nicely. On other occasions it takes all the strength you have, and in some instances more than you have, and we ask the fireman to help throw it over. These locomotives are equipped with foot braces and I always use them on the E engines. On the R engines they do not give me enough purchase, and I place my foot up a little higher. On the R–1 engines I am sitting with my back to the window braced against the back of the cab, with one foot against the back board of the cab, and the forward foot generally on the running board. (The record showed that in demonstrating this movement the witness remained seated in his chair and turned his body.) In switching movement on the R–1 engines, in reversing some of them you have to be mighty careful that you do not get your foot caught in there. When you are going forward and want to hook up the engine, you put your foot over that way [indicating] some-
163 times, and if the lever happens to get away from you it is liable to catch your foot on either the boiler head or the pipe. Occasionally the lever does get away from me. The greatest trouble is in handling the lever at high speed. You have to be very careful at high speed that it does not get away from you. When you try to hook it up or let it down it will jerk and sometimes get away from you. It vibrates back and forward. When the lever jerks in that fashion on an R–1 engine, I have never been pulled off the seat box, or anything like that, but it just goes to the corner. You let go after you have had one or two experiences that way. On the E engines some of them handle nicely, and again you will find some that handle pretty hard, especially in the corner. In reversing them I generally stand up and put your foot on the foot brace, and throw it over. When you are running along at high speed and have hold of the lever hooking it up you are not always able to let go of it. You have to be very careful that it does not get away from you, and in spite of all that it will sometimes get away. At high speed I have sometimes had the lever jump out of the quadrant and go to the corner without my touching it. If the lever rattles quite a bit and there is quite a bit of vibration I hold the handle of the latch down so that it does not jump out on me when I am going at high speed with the lever pretty well hooked up. I think the vibration at high speed and dry valves are two of the most probable causes of that. Worn bearings, quadrant, and latches, and so forth, and weak latch springs, have a tendency to promote that. We have quite a lot of bad water in my territory and the water is treated. When the engines work water they wash off the lubrication from the valves and that makes the engine handle hard (T. 695–700).

In hooking up a hard-working manual lever on the road it is almost impossible to keep looking out while you are making the adjustment. The time required to adjust the lever for one
164 operation varies a good deal between engines. Sometimes it might take you a half minute or perhaps a little more, and other times they hook up right away. I have had experience in yard

service, though not recently. In flat switching, where you are kicking out cars, I should say you will have to reverse the lever possibly 40 or 50 times in an hour. The shift is as near eight hours as they can make it, and some jobs run over. There is not much time lost in yard service now when the engine is not working. In commercial switching, where you pull cars out of sidings or have to spot them and do work of that sort, you handle the lever generally less than in flat switching. I would estimate in this service you handle the lever as high as twenty-five or thirty times an hour. In switching service with a hand lever you will invariably look to see where your lever is and take your eyes off the outside. In some instances you can keep a lookout where you are working ahead, but if you are working backwards you cannot always do it. I think this makes a difference in the performance of my duties. I believe it is safer for a man to see what is going on all of the time (T. 700–702).

I was injured by handling a manual reverse bar on July 17, 1925, in yard service with an M–1 engine, an 0–6–0 type, weighing between 140,000 and 170,000 pounds on drivers, which was equipped with Baker-Pillod valve gear. We were performing our usual switching service and got a signal to stop, and stopped. When I went to throw the lever back I made the usual effort, and it did not come back. I braced myself and tugged and pulled and finally got the lever to move, but wrenched my back in doing it. I was relieved of duty and was allowed to resume work after three days, but still had a very lame back. I do not know what caused the engine to work hard (T. 702–704).

On another occasion I was injured in handling a manual
165 reverse bar in freight service on an R–1 engine, a ten-wheel type, weighing 100,000 to 150,000 pounds on drivers. The date was July 20 or 21, 1929, and the place the Salem gravel pit. The engine was just out of shop, and I had to have the fireman help me practically every move with the lever. It was in forward motion and we got a signal to stop and back up, and he helped me to throw the lever back, and we tugged and tugged at it, and when it came back we didn't stop quick enough, and it caught my foot between the back of the cab and the reverse lever. It bruised the foot and made it black and blue and very painful. I asked the fireman to get me a pail of hot water, and I put my foot in the hot water for an hour as we went along. I continued working, but was lame for about three weeks. I reported it to the roundhouse foreman, but did not make any written report (T. 704–705).

I have had experience with Alco, Barco, and Ragonett power reverse. In reversing an engine with any of these gears I have had no difficulty. With manual reverse, in cold weather, there are times when it requires two men to throw over an engine, because everything seems to work very hard and the lubrication freezes. With power reverse I experience no difficulty whatsoever in the winter time (T. 705–706).

In handling the cut-off with power reverse there is practically very little effort and no fear whatever, but with manual gear at times it takes all of your strength and more, too, and there is the possibility of its getting away from you once in a while. With power reverse it is very easy to hook the lever up very gradually. With manual gear, while you can go through the same process, it is considerably slower. I don't hook up the lever with as many adjustments with the manual lever as I do with power gear. The purpose of hooking up the lever is to operate the engine economically and not use any more steam than is necessary. The power gear at any time
166 handles easier than the manually operated lever, especially on engines with Baker-Pillod valve gear, which handles exceptionally hard in most instances. My experience has been that you can switch more cars in the run of a day with power-reversed engines than with manually reversed engines in the same service (T. 706–708).

As to the relative safety of the hand and power reverse gears, I have never been injured with a power reverse gear, or seen the possibility of being injured with it, nor have I ever heard of anybody being injured with that type of gear, but with the manually operated gear there is always that possible chance of injury (T. 708–709).

CROSS EXAMINATION

I base my opinion on the fact that I have had injuries with hand reverse and not with the power type, and with what coemployees I have worked with. In the last year my experience has been about half and half with the two types of gears. Over a number of years most of my experience has been with the hand lever. As to the number of cars which I switch in a day's time, I have never kept any record of the difference between hand- and power-operated locomotives. The number of cars I switch is pretty well determined by the business on hand, but when business is real good and they use you every minute, it makes some difference whether I have hand operated or power reverse. The number of engines working in the yard depends somewhat on the business, but we have a number of little yards in which the engines work almost exclusively, one engine to a trick. Some engines also work in more than one yard. I am local chairman of the Brotherhood of Locomotive Engineers. If the use of power reverse gears would result in reducing the number of engine tricks in my territory I would sacrifice the number of engines for a power reverse gear (T. 709–712).

I spoke of being injured on engine no. 1363, an R–1 engine,
167 on the 20th or 21st of July, 1929. I reported the occurrence to the night foreman when I made the fact known on my work report that the engine handled hard. I told him I had hurt my foot. He did not ask me to fill out the accident report. I gave him to understand that the injury was not going to cause me to lose any

time. I made and inserted a stop pin at the back of the quadrant so the lever could not go down any farther than enough to clear my leg or foot. My foot was squeezed and no bones were broken that I know of. I have had no trouble with it since. The placing of the stop pin fixed it so there was room for my foot and no chance of its being squeezed (T. 712–714).

The M–2, M–3, and M–4 engines are switch engines equipped with power reverse gear, as are the class Z engines we use in switching. These are all larger engines than the M–1's, which are manually operated, and I would naturally expect to handle more cars in a day's work with them than the M's or M–1's, regardless of the type of gear (T. 714).

I use the same position in switching with an R–1, M, and M–1, which is to spread your legs so as to extend your right leg toward the front of the locomotive and the left leg back to the rear, from which position I am able, by leaning my head out of the window, slightly, to observe signals to the front or rear. Ordinarily I have to take my eyes off the men outside in reaching for the lever only a comparatively small time, but if the lever sticks, then I have to knock down my seat and get over and brace myself to throw it. That is not entirely just the case with an engine new out of shop. Most Baker-Pillod switch engines at certain positions throw hard. If there is an unusual length of time taken in throwing the lever I will naturally look out to see if there is anything doing, but not always. I can see from my position inside the cab if I am working ahead. When I said there were occasions when it would take me as much as half a minute to handle the lever, I did not mean
168 that those were the times when the lever worked unusually hard and I have to get the assistance of the fireman. My own experience is that at times it is hard to get the lever just where you want it. It will keep moving up and down and jerking, and it takes you that long to get it into the notch where you want it. I have reference now to hooking the lever up at high speed. When doing that I always try to observe everything is clear ahead of me first, and I devote my entire attention to the lever when I am operating it. I can turn my eyes ahead and observe the track in case I find that the handling of the lever takes longer than ordinarily. There is nothing to prevent me from looking out. If I am approaching a signal or interlocking plant or highway crossing when that happens, if I can get the latch back into the quadrant again, I certainly would make the observation. I cannot agree with you that, after raising the latch from the quadrant in circumstances where the lever might be vibrating, I can pull on the lever without raising the latch and feel the lever to see whether the valves are dry or whether it is going to pull forward. As to whether I have found a good many locomotives where I could do that, some of them that handle easy you can operate with two hands without getting up to brace yourself, but I find in my experience when you are going at high speed that you want to be braced and have every bit of your

energy and power to make that adjustment. By high speed I mean 50 or 60 miles an hour in passenger service. Under circumstances of that kind when I found the lever had a tendency to stick or pull forward I have not tried shoving down the throttle and giving the oil a chance to work in the valve. That occurs when engines are perfectly lubricated in my opinion. From my experience with the oily condition of the piston it indicates the engine is lubricated very well. I would not be able to observe that condition at the time the lever tended to work hard, but when I stop to make
169 my inspection I observe whether or not it is getting proper lubrication. The fact that, in making my stop, the throttle has been shut off, which would give the oil a chance to work to the valve, may have something to do with the lubrication of the piston to some extent, but the manufacturers of lubricators claim they are so constructed mechanically that the engines lubricate properly. Most of them function pretty fairly. I have not kept any record of the number of times I have to handle the lever, in the various types of services. I just mentally go through the process I go through in running a locomotive. In the first place the lever is in the corner, and then I hook it up a little more, and as the engine gains speed I hook it up a little more and a little more, and it takes about five adjustments to get it operating as efficiently as it will do. If I had the power gear I possibly might make six or seven adjustments and not move it quite so far each time. I accomplish the same results ultimately with the manual lever within approximately the same length of time (T. 714–722).

I have had experience with all three types of power reverse gears. I have not had a Barco that would creep. I find the Ragonetts have crept more than the other two; the Alco is fairly good. When the gear is creeping you notice a louder exhaust. That is an indication that the engine is getting more steam, indicating that the adjustment of the power reverse gear has permitted the valve to travel further and admit more steam. Then you hear a lighter exhaust and you know the gear has shortened the travel of the valve. This does not happen with any regularity or precision, and you cannot tell which way they are going to go, but usually they ultimately swing back the other way. Sometimes you have to adjust the lever to maintain your speed, and to overcome the creeping. With the Alco I have observed a fluttering of the cross head and pistons, in which it vibrates back and forth a very short distance. Nothing happens in the cab, but I can look out of the window
170 and see it. I have not noticed any vibration of the hand lever in the cab when the cross head is fluttering (T. 722–724).

From my time book I thought it was on engine No. 2016 that I had strained my back. I do not recall the fact that I had worked No. 2016 the day before and then worked No. 2039 on the day I was injured, and that I reported I felt I had sort of strained myself on the 2016 and then continuing with No. 2039 had continued to overexert the muscles, which finally resulted in the strain to my back.

I know when I threw the lever over I got the injury to my back. (The witness was furnished with a statement for the purpose of refreshing his recollection.) I have read the statement and refreshed my recollection from it. As to whether in substance the report that I handled engine No. 2016 on the previous day, and that it had worked rather hard, and on the following day, on which I noticed the strain in my back, I had been working for several hours on the No. 2039, I believe all told we went to work at 3 o'clock and this happened between four and five.

"By Mr. MOREHOUSE:

"Q. And you expressed the opinion in here that the combined strain that you had had on the previous day together with the strain of working on this engine was what produced the muscular strain in your back, did you not?

"A. I believe it all had a tendency to culminate in the final injury."

There was no jerking of the lever, just a strain in trying to get at it. The engine was standing and I was endeavoring to throw the lever from extreme forward to extreme reverse. I had engine No. 2039 for three or four days afterwards and did not experience any difficulty with it. I had never injured my back before, or had any trouble with it in any way. I had not opened the cylinder
171 cocks when I was endeavoring to pull the lever back (T. 724–727).

When I spoke about the Green Bay express run I gave an estimate of the number of times I handled the lever during that run, of a distance of 129 miles, with a running time of five to five and one-half hours. It is classified as a passenger run, but is a solid express run, and picks up and sets out cars. I operated power reverse as soon as the Northwestern first got them. I believe that 75% of my experience as engineer has been with manually operated reverse. I am 49 years old (T. 727–728).

REDIRECT EXAMINATION

When the power reverse gear creeps, I have not, in my experience, noticed the hand operating lever in the cab move at all. As to whether the creeping of the gear interferes with the operations of the engine, I generally adjust the lever to get the cut-off back to where it was before it started to creep, and that is a quick operation. I have never had an engine go into backward motion with me that I know of. If the lever creeps back to dead center, the steam would be trapped in the cylinders if the lever will center the valve on its seat. If that occurs there is no steam admitted to the cylinder and I suppose it churns what air is in there. I believe I could say that I had that happen to me. At least I felt I should move the lever and change the position of the valve. I never had a cylinder head blow off or anything go wrong with the valve mech-

anism because of the engine going into backward motion when I was going forward (T. 728–730).

L. J. LARSEN, a locomotive engineer employed by the Chicago & Northwestern Railway, was sworn, and testified as follows:

172 DIRECT EXAMINATION

I live at Norfolk, Nebraska, and was hired as a fireman on the C. & N. W. in 1904 and promoted to engineer in 1908. The territory in which I have had my experience is the eastern division of the lines west, operating three directions out of Norfolk, Nebraska. I have had experience in all classes of service. In passenger service we have some 4–6–2 engines weighing 140,000 to 170,000 pounds that are manually reversed, and also a class D engine, 4–4–2 type, weighing around 100,000 pounds on drivers, manually reversed. In freight service we have the R's, the R–1's, and in switching service the M's and M–1's (T. 730–732).

With the R–1 engines, manually reversed, the quadrant extends from the back end of the boiler to the back part of the cab, and the lever passes by the seat box, clearing it about three inches or such a matter. When the lever is in the back corner the top part of the lever extends out past the back board a few inches. In reversing the engine to back motion I usually pull the lever up to center and then get in front of it and shove it back. On the class D engines clearances are similar to those on the R–1 engines (T. 732–733).

With reference to the number of times I handle the lever on a run west out of Omaha in passenger service, leaving the Omaha terminal, it is heavy upgrade and the engine is working in the forward corner. The last three-quarters of a mile before reaching the South Omaha yards the lever is moved back so as to shorten the cut-off, as the speed is increasing. After leaving South Omaha it is down grade for about two and a half miles. After leaving South Omaha there you are slowing down to fifteen miles an hour for an automatic crossing, and the lever is put down far enough to again bring the train up to speed, requiring about three movements. Approaching

173 Irvington the speed is again reduced to fifteen miles an hour, and passing out of Irvington you go up a pretty good hill. The country is hilly for a distance of 30 miles out of Omaha. During this 30 miles, on a train that does not stop, I would estimate I handle the lever fifteen or twenty times. On a local train or train that does stop the number of times will vary. When I am picking up or setting out cars along the way it depends upon the nature of the movements. The lever has to be changed every time the motion of the engine is changed, and in continued operation the lever might be operated twenty or twenty-five times in half an hour (T. 733–735).

As to the strength required to reverse an engine, that varies considerably as to the type of valve gear and the condition of the reversing gear and weather conditions. The R–1 engines when in normal

and good condition work with less effort than any other type of engine. The class D engines I find are harder to operate and the E–1's are very difficult. The E–1's have Baker-Pillod valve gear; the class D's Stephenson motion. The E–1's have a foot brace, and some of the R–1's have a foot brace placed at the front end of the quadrant down next to the deck. I do not use that brace on the R–1's because it is not in a position where it would be of any benefit to me. Under such circumstances I usually put my foot up against the boiler head to get a better anchor. When I am thus braced, either with my foot on the foot brace or against the boiler head, my experience in handling the lever varies considerably, according to the condition of the gear and weather conditions, or if the cylinder valves are empty of steam. Running along at high speed with the engines pretty well hooked up, on an R engine, I had the bolt which holds the dog onto the lever break, letting the lever drop into forward motion. I did not have a hold of it. I had a similar type of engine on another trip, traveling about twenty or twenty-five miles an hour, and I went to throw the lever back. There was
174 no indication that there was any unusual strain on the lever, and when I unlatched it it went down into the corner and threw me into the deck from the seat box. The class E engines at a speed of over 30 miles an hour are difficult to handle, and I have had the lever get away from me. On December 24, 1927, about 5 miles west of Norfolk, I aimed to set the lever back about two notches but it slipped down about four notches, and when I let loose of the lever the latch caught in the quadrant. I asked the fireman to assist me and both of us got a hold of the lever and I unlatched it, but we couldn't hold it. It went into full gear. It was necessary to slow the train down to about 25 miles an hour before we could again hook the lever back. That gives you quite a body jar (T. 735–738).

With the type D and the R–1's I have encountered trouble in handling the lever at high speed; with the E–1's I have at times. I would rather reduce the throttle than to operate the lever. If the throttle is reduced below the point where the pressure is naturally maintained in the valve chambers the speed will reduce (T. 738).

An engine new out of the shop operates harder than after the gear is worn in, and if water happens to be thrown on the valve, causing the lubrication to be worked off, that causes the lever to handle hard. A leaky drip pipe, or in cold weather the oil congealing on the bearings, will also cause it to work hard. In through freight service, after the train is in motion, in the territory west of Arlington on the main line, the lever is not moved very often, but in the territory around Omaha, which is a hilly section, the lever is moved as often as is necessary for the engine to handle its load. It is invariably more often on a heavy freight train than in passenger service. In yard service, where you make and break up trains, the lever is handled very regularly during an eight-hour period, or
175 whatever the number of hours worked may be. Over an eight-hour period the handling of the lever has a tendency to cause

you to become tired, and there is a possibility of your being less alert as to the operation of the engine. As to whether this actually happens I will answer, yes; it does (T. 738–740).

As to the amount of strength required to handle the reverse lever on smaller types of engines with Stephenson or Baker valve motion as compared with a heavier type of engine with the Walscheart motion, I will answer, with the exception of the Baker-Pillod gear, the small type of engines with slide valves handle as hard as the bigger power with piston valve. The Baker gear is a harder gear to handle (T. 740–741).

I was injured in handling a manual reverse bar on January 23, 1929, at Long Pine, Nebraska, on engine no. 2206, a locomotive equipped with Baker valve gear. I was called for a passenger train. At Long Pine two cars were picked up to go forward in our train. While making the switch and reversing the lever from forward to backward position I placed my foot on a foot pedal located on the front end of the quadrant and applied all my strength and weight in bringing the lever back. At about the center of the quadrant my foot slipped over the end of the pedal, causing me to be pitched forward, landing on my feet in the front end of the cab. I noticed quite a pain in my left groin and called the fireman's attention to the fact that I thought I was hurt. In the course of about six days I consulted the doctor, and he found I had been ruptured. I was operated on that and lost 30 days' time. Between the time I was injured and the time I was operated on I experienced pains while on my feet. The company did not compensate me for time lost but paid the hospital and surgical bill (T. 741–742).

My experience with power reverse has principally been with the Alco, also with the Barco. I have never experienced any
176 trouble in operating any of my power-reversed engines. In cold weather I haven't had any experience but that the power gear would handle the engine. I have never handled any power reverse in yard service. As to the comparative strength required to operate manual and power reverse, the power reverse gear is handled very nicely with one hand, but with the hand reverse it requires your full strength. On the engines I have operated there is plenty of clearance between the power reverse mechanism in the cab and my body. The lever sits up ahead of you, fastened to the side of the boiler on a bracket. I have never been injured operating a power reverse. My experience with this type of gear has been off and on since 1922. I have been on regular assignments as high as three months at a time where we had power reverse (T. 742–744).

CROSS-EXAMINATION

These regular assignments were with class Z engines in freight service. Most of my time during the last nine years has been spent in operating manually reversed locomotives. I am 48 years old. I have not been in through passenger service very much in recent years

I have been operating a motor car for the past eight months, with the exception of about 60 days. While I was in the motor-car service my hernia became strangulated and it was necessary for me to have an operation. That occurred as I was leaving my boarding house. I stumbled and fell and had a fit of coughing, which caused the hernia to strangulate. The original strain to which I attributed the hernia had occurred nearly a year before, and that was the strain I told about on the passenger engine, an E–1, at Long Pine. The engine was standing at the time I strained myself, and the strain was caused by my foot slipping off the foot brace. I had my foot on the foot brace and was pulling back on the lever and my foot slipped over the end. This was on engine no. 2206. The engine itself did not jerk (T. 744–748).

177 When I stated that on the E–1's I sometimes pulled the throttle down running at high speed instead of hooking up the engine I did not have in mind that I would ease the throttle off and then hook up or adjust the lever and then immediately pull the throttle open again. What I had in mind was that on local trains if it became necessary that the cut-off should be changed in order to handle the train, and the lever be brought back another notch or two, rather than take the chance of the lever going down I would ease down on the throttle to economize on steam and water when a stop was made. I would leave the lever stand where it was. I would not say that in operating at high speed in passenger service I have eased off the throttle just before adjusting the lever and hooking it up, and then immediately opened the throttle. I do not know whether some engineers use this practice. The matter of water being thrown on the valve, causing the lever to work harder, is not a matter of frequent occurrence. We aim to keep the water in good condition on a trip, and will usually operate the blow-out cock if we have an opportunity. However, if we do not have an opportunity to do this we experience trouble from the water. That occurs as often as once a month. I could not answer how many times a month. It would happen under ordinary conditions. Another cause of the valve becoming dry is a leaky dry pipe, but that is just a rare occasion (T. 748–750).

On the occasion on December 24, 1927, when the lever went to the corner and I asked the fireman to assist me, I was running about 45 miles an hour on a passenger train. No one was hurt. We shut the throttle off altogether, and then we could pull the lever back. It pulls back very hard, and did at the time after we shut the throttle off. The cause of the lever getting away from us was not lack of lubrication, but was on account of the vibration of the gear.

178 There are certain points where it throws a heavier strain on the lever than at other places, and if the engine runs faster the train becomes more constant. That is the only instance where I can recall I had that experience. The territory I spoke of between Omaha and about 30 miles out from Omaha, which brings me to Arlington, is the hilliest part of my entire territory. After I leave

Arlington the road is a water level route all the way. When I spoke of handling the gears twenty or twenty-five times in continuous operation I had in mind a switching movement, so that if I were switching continuously for thirty minutes my estimate was that I might move the lever twenty to twenty-five times. I have not any correct knowledge as to how many times the lever would be moved. That is just a rough estimate. I do not recall having had any accident which I attributed to my having become tired or less alert through a day's work (T. 750–753).

WILLIAM H. STRINGER, a locomotive engineer employed by the Chicago & Northwestern Railway, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Milwaukee, Wisconsin, and was hired on the C. & N. W. in 1910, and promoted to engineer in 1916. I run between Milwaukee, Fon-du-lac, and Chicago, and have had experience mostly in freight and switching service. I have the same classes of engines as were described by witness Rudolph. As to my experience concerning the amount of strength required to handle the lever on the manually reversed engines, I find it takes considerable strength. With the exception of class E engines which have a spool-shaped foot brace in front of the quadrant, the only foot braces furnished by the company are those which the men have put there themselves. I use
the brace when it is furnished. On the engines that are not
179 equipped with them it is my practice to put my foot against
the injector pipe or in front of the cab. When I am braced, either with my foot on the foot brace or against the injector pipe, I have had the experience of the lever jerking or getting away from me on class R and R–1 engines used in freight service. These weigh 100,000 to 150,000 pounds on drivers. On those occasions when you attempt to raise the lever out of the corner it jerks and has a tendency to pull you off the seat box. I have had that happen to me and it puts a strain on my back. This could be caused from worn parts of the machinery, dry valves, poor spring in the reverse lever latch, or worn teeth in the quadrant (T. 754–756).

I was injured by using a manual-reverse lever on January 25, 1929, at Wiscona, Wisconsin, on engine no. 29, an R–1 class of engine. Leaving Butler yard I noticed the valves were dry and I increased the lubrication, but as I went along the lever began to pound and rattle and got worse all the time. I tried to raise the lever several times but I could not. Finally I was determined to get it out of the corner and I placed my foot on the boiler head and pulled with all my strength and succeeded in getting it out of the corner. I got the lever about half-way up the quadrant but I found I could not hold it and my foot slipped off the boiler head and was pinched between the reverse lever latch and an air pipe. The lever went down into the corner very hard. My foot was caught between the end of the

quadrant and the air pipe. There was about three inches clearance there. I slowed the train down and released my foot. I had injured or squeezed two toes and was off duty on account of that about six days (T. 756–758).

I find that the cut-off can be adjusted much easier with the air reverse than with the manual lever. I have never had a power reverse lever get away from me. I find that you can do more work with a power-reverse engine, and keep your eye on the man you are
180 working with. It takes very little strength to operate the power-reverse lever. As you are running along and want to hook up an engine with power reverse you can keep a look-out at the same time. In the winter time I find that a manually reverse engine is hard to handle with the oil in the links cold and stiff. It is much easier with power reverse in the winter time (T. 758–759).

CROSS-EXAMINATION

I have been operating power-reverse engines off and on for six or seven years, and during the past six years I would say that I have operated more with power than with manual reverse, and that has been mostly with switching service. The engines in switching service, which are equipped with power reverse are largely the more powerful engines and capable of doing more work in a day's time than the manual-reverse engine. There are four or five R–1 engines in service in my territory.

By Mr. MOREHOUSE:

"Q. And because of the lever working hard and because the valves were dry, the engine having been in storage and lubrication, when you first started out on your trip, not having worked down to the valves promptly—is that correct?

"A. Yes, sir.

"Q. You stated the hand lever rattled or vibrated, and gave you warning of that fact, did you not?

"A. Yes, sir."

I made up my mind I was going to get it out of the corner anyhow. If my foot had not slipped, it would not have been hurt. The place where I put my foot to brace myself ordinarily is higher than the lever. In this particular case, when I thought I was not going to be able to hold the lever and was going to let it forward again, I did not get my foot out of the way, but it got down next to
181 an air pipe. It just happened to catch my foot at the wrong angle at that point in order to squeeze my toes. A three-inch clearance there is ordinarily enough. By the time I got to Milwaukee, the lever was working good; the lubrication had got down to the valves. Prior to starting my trip that day I failed to oil the links and driving boxes, but I had turned on the lubricator so that the oil would be condensed and would seep down into the valves. I had oiled the eccentrics. There is an indicator plug, which you can take out and oil the valves before starting, but it is not customary

to take those plugs out. When I spoke of a loose spring and worn teeth in the quadrant causing the lever to handle hard, I did not mean to say that those conditions will have any effect on the hard handling of the lever. I am forty-one years old (T. 760–763).

A. G. RASMUSSEN, a locomotive engineer employed by the Chicago and Northwestern Railway was sworn, and testified as follows:

DIRECT EXAMINATION

I live at Waseca, Minn. I was hired by the C. & N. W. in 1910 and promoted to engineer in 1916. I run between Winona, Minn., and Watertown, S.D. I have had experience in all classes of service and with the same engines as witness Mr. Rudolph described, both hand and power reverse (T. 764–765).

Some of the manual-reverse bars on those engines require all the strength you have and others handle fairly easily. New engines handle hard. Cold weather and dry valves also make them handle hard. When the engines come out of the shop they are tight, and that is usually the cause of them handling hard. After the engines are used a while, we have to contend some with lost motion and that gives the lever a chance to vibrate. As to what experi-
182 ence I have had with the lever jerking when I am running along and attempting to handle it at high speed, most of them jerk some, some more than others, depending on whether the valves are dry or there is lost motion or vibration. We have foot braces on those engines. In freight service, the through freight engines are all power reversed. In local freight service, the R–1 class, which we use, are manually reversed. The foot braces on those are down so low they are no good, and you cannot get your foot on them to any advantage. You put your foot against the boiler head, or some pipe to get more power. With your foot in that position you sometimes have difficulty in handling the lever. It is jerking, and sometimes jerking so bad, it would get away from you. I have never been injured by the reverse lever jerking on a manual-reverse engine (T. 760–766).

I was injured while assisting an engineer to handle a manual lever about November 19th, 1925, near Dodge Center, Minn., on engine no. 1605, a class E, 4–6–2 engine, used in passenger service. We had left Dodge Center and the engineer had hooked up the lever gradually. We gained speed and got out a mile and a half and were going to hook the lever up, and it got away and went down into the forward corner. I saw the engineer could not get it out while he was pulling on it. I stepped over to help him and by so doing strained my back. The lever was in the forward corner when I went over to assist him. I stepped up on the running board beside him, reached over with one hand, got hold of the lever and helped pull it back. He was also pulling on it at the time. I strained my back by pulling on the lever. After we got it started it jerked us, and I

imagine that is what caused the strain. I was off duty fifty-eight days on that account. The company paid me $200.00 (T. 766–768).

I have never had the experience of a power reverse lever jerking, nor have I ever had a power reverse lever that would throw the
183 engine over. In cold weather I have not had any difficulty with the power reverse mechanism becoming inoperative or freezing. I have had experience with Alco and Barco power reverse. I have experienced creeping only once that I can recall. The lever was stationary while the gear was creeping. I did not do anything to overcome the creeping. The gear creeps down in a forward motion anywhere from two to four notches, and then hooks itself back again (T. 768–769).

CROSS-EXAMINATION

I have never had a power reverse gear get out of order. Since we have gotten power reverse gear, which was in 1922 or 1923, I have been on power-reversed engines about one-third of the time I have been running. Prior to that my experience was all on manually reversed engines. At the time I strained my back my engine was running about forty-five miles an hour. The lever had gone to the front corner and I stepped over to assist the engineer. He did not ask me to do that. I reached over and took hold of the lever with one hand. The lever on that E engine, when it is in forward position, is alongside the boiler. I reached around the corner of the boiler, standing on the running board where the seat box is. There is a step between the deck and the running board. I do not think I had one foot on the step. I think I was standing on one foot. That is about the only way I could get in there, on account of the small amount of room there is with the engineer up there. The engineer was on the right-hand side of the quadrant—on the other side from me. My idea was to help him pull the lever back. I could not say whether he closed the throttle. I think the valves were dry at the time. I do not know whether the engineer had been watching the lubricator prior to that time. I had not been watching it and do not think I could see it operate from where I was. It is placed in the cab so that the engineer can see it from his place on the seat box. The force of the lever was toward the forward corner
184 and both of us were pulling back on it. After we got it started out of the corner it jerked us and vibrated. I was leaning around the corner and throwing my weight almost entirely on one foot and because of the position in which I was placed, in pulling on the lever, I strained my back. I think I was in bed two weeks. I could not get out of bed. I do not recall whether the doctor diagnosed my case as neuritis. There was no complication more than the strain itself that I know of. I noticed the strain right away to some extent and as I went on with the run it got worse. I think we had gone about half-way over my 135-mile run when the accident happened. I fired on the other end of that run. We got

about eight hours rest and then we went back. I first told the engineer about my having strained my back shortly after I felt I had hurt myself. I made no report to the company until I got back to Winona. In the ordinary run of my work I handle the hand levers without any particular difficulty after they are worn down and when weather conditions are favorable. By the phrase "after they are worn down" I mean after they have been broken in coming from the shop. I would say weather conditions are favorable except when it is extremely cold weather so that ice forms on the gear box. Wet weather has nothing to do with it. It does not have to be both cold and wet in order to form the ice. There is more or less steam around there, which forms a frost on the iron. By extreme cold weather I mean temperatures from ten above zero to as cold as thirty below. The effects of zero weather upon handling the lever comes from the oil getting stiff and frozen on the iron (T. 769–776).

I was promoted to engineer in 1916 and have spent somewhere between one-third and one-half of the time since then running an engine. Of that time, I believe one-third has been spent on power reverse engines. I am 43 years old (T. 776–777).

185 REDIRECT EXAMINATION

When I first began my testimony I think I mentioned that dry valves had something to do with the lever working hard. Cold weather does not have anything to do with creating dry valves. Dry valves are caused by foaming water washing the lubrication off the valves. I have had some experience with water foaming. That has the effect of making the engine handle hard. When I was answering Mr. Morehouse's question about the jerking of the lever on the occasion when I was assisting the engineer I made certain movements with my arms. I indicated that the lever jerked, what I would call violently (T. 777–778).

RECROSS EXAMINATION

When I used the word "vibrating", I would mean just quivering to a certain extent, while by using the words "jerking violently", I would mean that it would actually jerk my body or arm. On the occasion about which I was talking, the lever jerked my body and arm. It pulled forward and back and pushed against me, as well as pulled after we got it started out of the corner. Foaming water causing the valves to get dry occurs quite often in my territory. On those kind of runs I imagine it occurs at least once a week. I have fired runs this spring for probably six weeks between Waseca, Minn., and Tracey, Minn. I could not give you the numbers of the engines I used, but it was a regular passenger run and the engines go from Winona, Minn., to Huron, S.D., so we do not have our regular engines. During that 6 weeks I have a definite recollection of the water foaming at times. I could not tell you the time. I want you to

understand that the water on those occasions foamed to such an extent that it washed the lubrication off the valves. I could not say how many times this happened. When an engine foams it usually does wash the lubrication off the valves. I did not observe
186 the engineer adjust the lubricator on any of those occasions. I did observe him having difficulty with handling the lever on those occasions and that the lever would jerk when he went to adjust it. When he would unlatch it it would have a tendency to go forward. He did not get hurt. During this six-week period the engineer followed the practice of using the blow-off cock when he could. He handled the lever in the usual way, excepting that it handled harder. Engineers are instructed to use the blow-off cocks between stations on account of foaming water (T. 778–783).

J. R. ADAMS, a locomotive engineer, employed by the Wabash Railroad, was sworn, and testified as follows:

DIRECT EXAMINATION

I live at Decatur, Ill. I was hired by the Wabash in 1907 and promoted to engineer in 1912. My territory is the Decatur division from Decatur to St. Louis, and Decatur to Cilton or Danville. I have had experience in all classes of service. At the present time we use, in passenger service, a 4–6–2 type of engine, weighing about 150,000 pounds on drivers, equipped with manual reverse bar, and an Atlantic type, weighing about 100,000 pounds on drivers, equipped with manual reverse gear. In through-freight service we have no manually operated engines. In local freight they are all power reversed, except one, I believe, on a branch line. Most of the switching engines are manually reversed, weighing from 140,000 up to 185,000 pounds on drivers, both six- and eight-wheelers. These switch engines are equipped with Stephenson motion and some of them with slide valves (T. 778–785).

As to clearance on the manual reverse switch engines, on the B–7's, which are six-wheel engines, the clearance between the reverse lever and the side of the boiler head is between two and three inches, and everything is kept in its place. The lever just does go by the
187 seat and that is all. You cannot sit on the seat and operate the lever in back motion satisfactorily. I stand up with my back toward the outside of the cab usually. That type of engine is a deckless engine. We also have in the yard a 2–6–2-type engine, known as a "G–1", weighing 150,000 pounds on drivers. You have plenty of clearance if your reverse lever is in the forward motion, but in back motion you can hardly stand in the back of the cab and put it in full back motion. If the lever is in full back position, you reach over toward the lever tc get to either brake valve. If you were sitting on the seat and the lever would go into back motion, it would strike your body. In forward motion there would be no

danger. We have the same engine rebuilt into a passenger engine, except the cab is a little bit longer (T. 785–787).

As to the occasions when we have to handle the manual reverse bar, going over a run in passenger service, on the Decatur division proper, we have no hills where we have to shift them, but on the Peru division, which is practically all hills, we do shift. If you stop at the foot of a hill you have to put the lever in full forward motion and gradually hook it up as you get speed, and you probably do that four or five times in hooking up the engine to proper position. In starting an engine at a station, if the slack is out of the train you have to put the lever in back motion to start the train, and then put it in forward motion. Naturally in trying to start a train you would have your cylinders full of steam, and it takes all the strength you have and sometimes more, to reverse the engine. Sometimes you have to call for assistance from the fireman. As a rule our switch engines work reasonably well and we very seldom have one that is unreasonable to work. If they come out of the shop new they are naturally tight and hard to work for three or four days. The switch engines have a foot brace, but I do not recall that the passenger engines have them. On the Atlantic type of pas-
188 senger engines, manually reversed, you put your foot on the boiler head to get purchase and give you more power. With my foot brace in that position I have experienced the lever getting away from me. On May 4, 1929, the lever went to the corner and broke my foot, cutting it badly. I have had the lever get away from me while hooking up the engine at frequent times, but I cannot recall any particular date. When I am hooking up the lever it is hard to pull back and hard to place in the proper notch. Sometimes you get it near the proper notch and it gets away from you and goes to forward motion. It is pretty annoying and pretty tiresome lots of times to handle the lever and it is also dangerous. You are liable to get caught anywhere with it, or ruptured or to strain your back. As to why the lever jerks, in the fashion I have described, it is caused from the pull on the valve, most frequently by dry valves. In passenger service you cannot keep a lookout when you are hooking up or dropping down the lever. It takes a minute or less to hook up an engine. You handle the lever considerably more on a freight engine than running a passenger engine, because you are pulling tonnage on freight, and if you come to a little hill you will drop the lever a notch, and as soon as you get over it you will pull it up. With a passenger engine the locomotive will take you over the hill. In local freight you use the lever every time you make a switch. In an eight-hour local run you will probably put in five hours in switching. It is rather difficult to tell how many times I will have to handle a lever in one hour because maybe you will be spotting a string of cars and cut off and move to the next spot and maybe not move your lever. If you are putting them on different tracks, every time you go to a different track, of course, you reverse your engine. I recall an old 800-class engine with slide valves, of which we have

only two or three in our territory. They were very hard to handle, and after I was used to the modern power they are kind of an aggravation (T. 787–791).

189 I was injured in hooking up a manual lever on May 4, 1929, at Blue Mound, Ill., on engine no. 664, a J–1 Pacific type passenger engine, weighing about 150,000 pounds on drivers. I was at the foot of a hill. Coming down the hill at a high rate of speed, about 60 miles an hour, the lever had worked itself down a couple of notches. I eased off the throttle and went to hook it up, and the lever went to forward motion and caught my foot between the reverse lever and boiler head. I did not make much of an examination, but from what I could find out there was about $\frac{1}{16}$ of an inch clearance. The lever held my foot until I stopped the train and the fireman assisted me to get it off my foot. I was thrown off balance but not thrown off my feet. The train went 1,000 or 1,500 feet while I was being held there. I would never have been able to get my foot out myself. The foot was broken and badly cut. I was off duty seven months on account of it. The company paid me $2,000, or full time. The locomotive was equipped with a Nathan force-feed lubricator. So far as I could see it was in good order at the time of the accident, and the pistons looked like they were lubricated when I took charge of the engine at Decatur. Since my accident they have equipped this locomotive with Alco power reverse gear (T. 791–794).

I have had experience with power reverse gear and have never had any difficulty whatever in hooking up an engine equipped with power reverse. I have never had any delay with any of the power-reverse engines. Some of them work a little slower on account of the opening, but they have always worked satisfactorily and safely (T. 794–794).

CROSS-EXAMINATION

The power gears which work slow would probably take not over three or four seconds to work. I have run but two power-

190 reverse engines in yard service. As to the manually reversed engines in yard service, some of them are awfully hard to handle, the B–4 class, I think there are about five of them with us. The B class reverse nicely except, when they are new, they are awfully stiff and hard to handle. Four or five days' work will generally loosen them up. I have had the roundhouse loosen up the bushings on an engine just out of the shop. There was no stop on the end of the quadrant on engine no. 664 on which I was injured, or on engines of its class, and I never could figure it out whether there was room for one. That was the first time I have ever run that locomotive, and I never got it again until after it was power reversed. When that engine came to us in 1912 it was equipped with a power-reverse gear which had later been taken off and the hand lever substituted. I do not know the name of that type of power reverse, but we all know it was no account. (It was a Mellin gear,

T. 815.) I do not recall operating that particular engine when it was equipped with the first kind of power gear. I had not seen one of those old gears for quite a while. They are all Alco's that I have seen lately. The old type of gear, which I call "no account", had a great long lever, longer than the hand lever, and what was called a double lever, and it was never satisfactory at all. They had a short lever, running from where it fastens to the mud ring down under the deck up to the quadrant. The big lever, as I understood it, was to unlatch that and move it forward. They had lost motion. You had to move the top part of the lever to one side before moving the lever with the latch. The long one was more or less of a trip lever. The gear was operated by air pressure, which was located right under the deck on the engineer's side. It was very unsatisfactory after being worn and hard to keep up. They were all right when perfectly new, but the quadrant would move and work up and down. The short lever was the one which would reverse the engine,
and it would move back and forth and cause the valve gear to
191 flood. I never had the engine go into reverse motion because of that, but I heard fellows talking about it (T. 794–799).

I do not know what was the cause of the lever on engine 664 going forward. The Nathan force feed mechanical lubricator, with which it was equipped, is set before the engine leaves the terminal and is supposed to feed the proper amount of oil to the valves at all times. If it gets out of adjustment there is nothing I can do about it until I get to the round house. We have no right to change them unless something breaks. The valves on this engine were not dry when I received the engine, and when I was injured I certainly did not make an examination of it. Fourteen miles of run intervened from the time I took the engine—probably an hour. I had my foot on the boiler head and there is no other place on those engines where you could brace it. It is practically the only place where you can put your foot on account of the brake valve and piping and have any purchase or pull with your leg. I have operated that class of engine, which is a J–1, on other occasions, I cannot recall when those manual levers were put on the engines, but ever since they had them I had operated them off and on. I was not in that service regularly, but I have operated other engines of the same type as the No. 664. As to how I managed to keep my foot from being caught on other occasions, sometimes I would get up and stand inside the cab clear out of the way from there, off my seat, and stand facing the right window, but that is a very dangerous practice. There is no brace whatever there and no room to put one on. I never requested a brace, nor did any of the men that I know of. There is very close room in front of the engineer's seat box for you to slide through, on account of the automatic valve. You could squeeze through by turning sideways.
We do not often have occasion to do that. As to whether there
192 is any reason why there could not be a brace or bracket put there, up from the running board floor, I will answer that you

could not get your left foot on it, and you would have to turn your right foot in order to get the purchase. It would not do much good. It would not be a safe proposition to brace your right foot on it. There is an injector pipe which comes down between the brake valve and where the reverse lever comes. That is what takes up the room so that you would not have any room for your foot outside. I would not think they would want to put a brace on a steam pipe. It would not do any good. You would have to put your leg in front of the reverse lever. The pipe is to the left of the reverse lever. The place on the boiler head where you put your foot is not practically the only place where you put it in order to get it pinched if the lever came forward. You could put it other places to get it pinched. You put your foot in the best place to get the best purchase. I would not figure on the lever going forward. The reason I did not figure on it going that way was that it never happened before. I have had the levers on those engines go into forward motion before. It won't happen every trip, but there has been an awful lot of complaints about them going forward. There is a clamp made of a sort of strip iron about an inch and a quarter wide, which holds the injector pipe and is located about eighteen inches above the running board, and then another one farther up. They go around the injector pipe and fasten to the boiler head on a bracket. The handle of the lever is within a fraction of an inch of the boiler head. My foot must, at the time of the accident, have been up pretty well near the top of where the lever comes to the boiler head. The bottom of the lever slopes out from the boiler head as it goes down, but not a great deal because the boiler head slopes with the lever, but it is closer at the top than it is down below (T. 799–805).

193 We have some yard engines in the Decatur yards weighing over 200,000 on drivers, a C–3 class, which are not equipped with Stephenson motion. I said if the hand lever did fly back on these switching engines it would catch you. I had never myself had one fly back. The slow speed which prevails in yard service is the reason why they do not fly back the way they do in road service. The levers are not so apt to fly out of the quadrant in the switching service as on main line service because we do not hook them up as much in that service. We are usually picking cars and the lever is in one corner or the other when we are moving (T. 805–807).

I spoke of the difficulty in handling the lever when the cylinders are full of steam. If we are out in the open and clear we are supposed to open the cylinder cock when we have that kind of condition, but we are not supposed to do it where there are men working around the passenger station, or passengers are at a depot, or anything of that kind, or where we would blow dirt over them, or blow dirt over the depot platform. There are very few places where you can open the cylinder cocks freely. It is true that in switching around in ordinary yard service there is little to prevent you from opening the cylinder cocks unless a man is working there. You have got to watch out for that. They may be working under

the car by the side of you, where you cannot always see where they are. I do not open the cylinder cocks when we are around a passenger station but otherwise I do where it is a safe proposition. Not a great deal of my work is around the passenger station, but we have two engines that are around the depot all the time, three shifts a day. I have operated these engines, but not at the present time. I have operated the cylinder cocks of my engine when out in the country. On engine 664, prior to the time I got my foot hurt, the fireman used the small blow-off cock as soon as we got out to the edge of Decatur, probably a mile, and used it until
194 we got to the foot of Boody Hill, about one or two miles from the point where I was injured. I am fifty-five years old. When I got that engine in the round house that day I reversed the lever two or three times before coupling to the train, and it worked very nicely. I noticed the lever was awfully close to the boiler head. I certainly would not have put my foot there if I had known the lever was going to the corner, but I have got to operate the engine. The lever went to the corner after I had unlatched it in an attempt to hook it up. It did not jump out of the quadrant. It had jumped forward three or four notches and kept working itself down. That was due to either a worn quadrant or the quadrant had dropped a little. That is what I meant by "jumping out of the quadrant." The lever always goes forward to the front corner when that happens in forward motion. I first began operating power-reverse gear in 1912 when they got a number of them. Then they took those off, starting about four years ago and changed them as the engine went through the shops to Alco. I estimate that about 75% of my time running has been spent on power-reverse engines (T. 807–814).

Mr. Gouthant of the Wabash stated for the record that the type of power reverse gear having two levers, which the witness Adams described as having been taken off from some of his engines, was the Mellin gear (T. 814–815).

BERT UNDERWOOD, a locomotive engineer, employed by the Wabash Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Detroit, Michigan, and was hired as a fireman on the Wabash in 1910 and was promoted to engineer in 1917. My seniority district is Detroit to Montpelier, Detroit to Toledo, and the Toledo terminal. At present I am working in the yard at the ter-
195 minal. I have had very little experience in freight and passenger service. My work has been principally in yard and transfer service. In the Detroit terminal we have a B–7 type of six-wheel switcher, weighing 154,000 pounds on drivers, a B–8 six-wheel switcher, weighing 158,000 pounds on drivers and an I–3 consolidated engine, weighing 200,000 pounds on drivers, all manually

reversed. At Adrian, Michigan, they have a G–1 engine, manually reversed, weighing 150,000 pounds on drivers, a 2–6–2 type (T. 815–816).

On the B–7 deckless engine there is plenty of clearance at both ends. On the boiler side of the reverse lever there is three to four inches clearance; on the cab side not so much. By the cab side I mean between the lever and the seat. On some of them there is not any clearance. We have drop seats and operate these engines standing up. The B–8's are about a half-deck engine. The bottom of the reverse lever is fastened to the right back corner of the mud ring, hung on a bracket. In order to reverse these engines from full forward to backward stroke you have to get off your seat and stand up. When you are running along you sit on the seat box at times. The lever then would be right alongside your leg, or your knees would be beside the lever. In reaching for the throttle with the lever in back motion you reach over the lever. If the lever should come out of the quadrant and go back and forth over the length of the quadrant it would strike your arm when you are attempting to handle the throttle (T. 816–819).

It is pretty hard to describe the amount of strength that is necessary to reverse one of our engines in the Detroit terminal, because all engines do not handle alike, but an engine new out of the shop will require you to exert every ounce of strength. As to engines that are not new out of the shop, if they are well lubricated you
196 can handle them pretty well, some of them. If they are not well lubricated, of course, you have to exert more strength. In some cases we can break in an engine, new out of the shop, in less than four or five days, but in other cases it takes thirty days. As to other conditions which bear on the amount of strength required to throw over an engine that has been broken in, weak counterbalance springs or improperly adjusted counterbalance springs, tight bearings and dry valves are such factors. We do not have so much difficulty with the engine foaming in yard service, although there are occasions when they do. It is pretty hard to determine how rapidly we have to make the movements of the lever in switching service. It depends on the work and how easy the engines handle. We have street crossing, where we are required to reverse the engine. If the cylinders are full of steam they are very hard to reverse. Our switch engines are equipped with foot braces and we have to use them because the engines handle hard enough that we need them. Using the foot braces we have difficulty at times. If you are standing still it is usually a straight pull. If you are moving along in transfer service if your valves get a little dry, and you want to hook up the lever, you will get a jerk. I have had the lever jerk out of my hand in transfer service (T. 819–822).

I was injured by a manual reverse bar jerking out of my hands on September 7, 1927, at Oakwood yards, on engine no. 497, a B–8 six-wheel switch engine, weighing 158,000 pounds on drivers, equipped

with Stephenson motion. We were standing still, and I was reversing the engine standing up, and had reversed it from forward to backward motion. The lever was a little back of center. The counterbalance spring broke, throwing we forward against the throttle lever and it hit me on the neck. I fell on the throttle. It resulted in a temporary paralysis of the vocal chord and for three days I could not make a sound. I was off duty about twenty days on
197 account of that injury (T. 822–824).

I have had experience with power-reversed engines in yard service and have not had any difficulty in reversing an engine equipped with them. We use Ragonett power reverse. I would not say that it took any more strength to reverse an engine with power reverse than it would take to operate the Automatic brake valve, which is very little. I have never been injured in operating a power reverse gear. As to the comparative amount of time it takes to throw over a manual and power reverse engine, it would depend on the engine. If you had an engine that would reverse easy with a manual reverse you could throw it over in approximately the same length of time as the power reverse, but if you had one that handled pretty hard, it would take a longer time. I would say twice the length of time or more. Taking the general run of engines that we have in yard which are manually reversed and power reversed, I would say that there would be a difference of twenty or twenty-five minutes in an eight-hour shift which will be spent in reversing the engine with the two classes of gear. With a manually reversed engine my physical condition is getting pretty slow by the end of a day's work—I am getting tired. A man's ability is not the best if he is tired. With the power reverse we do not seem to mind the day at all. I lay the difference in my physical condition to fatigue caused by the heavy work of handling the manually reversed engine (T. 824–826).

CROSS-EXAMINATION

I do not mean you are not tired at all at the end of a day's work; you will be tired when you go home, but there is more physical strain when you are throwing the hand lever than when operating the power gear. I do not think that I ever had an accident occur on account of being more tired with the manual gear. As to how
198 I arrive at my estimate that it might make a difference of twenty to twenty-five minutes in a day's work by having a power gear, I will say that if you have a manually operated engine naturally you will handle the reverse pretty slow on one which operated pretty hard. I am comparing that with a power gear which works perfectly and works fast. I have had power gears which have also worked slow, but I do not remember ever having one which did not move the mechanism faster than you move it on a hard-working manual lever. I would say I have had power gears which worked

approximately as fast as I could throw over the hand lever on an easy working manual engine. With both types of levers working properly there is practically no difference between them as to the length it takes to operate them. With the power gear the operation of the control lever in the cab and the throwing of the valves from one position to the other is practically the same. I was considering, in my estimate, simply the handling of the lever in the cab. As to where I got the estimate of twenty to twenty-five minutes difference in a day's time, I will say that if you have a hard engine to reverse there are times you have to have the fireman help you. There are other times when you have to open the cylinder cocks. I am speaking of manual reverse and drawing an estimate from that. My estimate is not based on the assumption that I would require the fireman to assist me practically every time I had occasion to throw over the lever from one extreme to the other, because in the course of a day, even though the manual lever reversed hard, there would be times when one man could operate them. The difficulty would be caused by steam in the cylinders or some particular position of the gear which would make it work harder on certain occasions than on others. Even when I have a manual lever which is not what I would call a hard one to handle, I have to brace myself and
199 exert lots of strength, and give it a hard pull. I would not say that it is ordinarily easy most of the time. I have to put my weight against the lever (T. 826–831).

In our yard we have four G–1 engines which are the deckless type, and I have had quite a lot of experience on them. I have had experience with the power-reverse engines ever since they came, which was in 1922 and a little later. They work the G–1's in short switching and transfer service. They are in the Adrian yards. I have not experienced the Ragonett gears creeping in yard or transfer service. We have had them creep in road service. I have experienced that possibly three or four different times. Just the piston in the air cylinder moves, possibly an inch or an inch and a half, and I became aware of it because of the different sound in the exhaust of the locomotive. I am not able to say positively whether it moved an inch more or less, but that is my estimate of it from being in the cab. That creeping happened over two years ago. I have been in the yard now for two years (T. 831–833).

On the occasion when I was injured, the band on the counterbalance spring broke and that released the pull of the spring against the valve, allowing the full weight of the valve parts to pull the lever forward. I held on the lever so tightly that it pulled me forward and brought my neck in contact with the end of the throttle handle. About an hour afterwards I lost my voice. It was a temporary condition lasting three days. I would say, since 1922, about 60 percent of my time has been spent handling power reverse. Prior to 1922 my experience was confined to manual operation (T. 833–835).

REDIRECT EXAMINATION

When the Ragonett gear was creeping nothing happened to the lever in the cab. The only thing I did about it was to drop
200 the lever down a notch. It was just a matter of a minute or a few seconds. As to how near the center you will eventually place the power reverse lever in running over the road and making up speed, it depends on your train. With a light train when you get up speed you hook the reverse lever approximately on center. You will ordinarily be one or two notches ahead of center. As to how many times you will do this going over the division, there are lots of trains which we do not stop all the way over the division and it will run practically all the time that way. It was stated for the record that Witness Underwood is 44 years old (T. 835–836).

201 WILLIAM A. GARMAN, a locomotive engineer employed on the St. Louis-San Francisco Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Oklahoma City. I was hired as a fireman in 1902 and promoted to engineer in 1905. I run between Oklahoma City and Quannah, Texas. I have had experience in all classes of engine service. We have the following locomotives equipped with manual reverse gears: The 1100's, a 4–6–0 type, weighing 168,000 pounds on drivers, and some others as light as 142,000 and 114,000 pounds on drivers; in freight service, the 1200 and 1600's, the 1200's being a 2–8–0 type, weighing 168,000 pounds on drivers; in switching service the 341's to 354's, an 0–6–0 type, 94,000 pounds on drivers. We also have three freight engines, used in switching service, weighing from 114,000 to 172,000 pounds on drivers (T. 836–838).

As to clearances on the 4–6–0 engines, used in passenger service, I made measurements of the one I am operating now. When the lever is in the back corner of the quadrant, it is three inches from the side of the cab, and the back end of it extends three inches outside of the cab. It is twenty-two inches from the center of the quadrant to the back of the cab. I cannot reverse the engine while sitting on the seat box. I get down on the deck. There is about four or five inches clearance between the lever and seat box. I have about fourteen inches of space for my feet from the seat box and brake valve. The lever is five inches from the boiler head in full forward motion. The lever is about forty inches in length from the floor of the cab to the top of the lever. You can get no leverage on it to reverse it. As to whether there is any significance in the fact that I have fourteen inches of space for my seat, I will
202 say I have not got room to balance myself, or get in motion to use any power to reverse the engine. That being the case, I get down into the deck and pull the lever over, and get back up and look for another signal (T. 838–840).

As to the amount of strength it requires to reverse one of our engines, I generally have to brace myself to get them over—when I get down in the deck it is so far away from me that to pull it over I cannot get ahold of it if I am standing on the level. I do not have to have assistance in passenger service, but in freight service I do. In passenger service, when I am hooking up the lever at high speed I always brace myself by putting my foot on the boiler head, brake valve, or some appliance close enough. When I am braced in that fashion, as a rule, the majority of the levers handle hard. We generally get ahold of them and wait until the leverage gives you a momentum and then pull them back quick. Sometimes they are stronger than you think they are, and you have to let them go, and they go to the corner or drop and latch about one-half way, wherever you can catch it to hold it from going to the corner. You put it in the first notch you can to keep it from going to the corner. I have had experience with the lever jumping out of the quadrant when I am not attempting to hook it up, and it goes to the corner. I have had no trouble with that at slow speed. I would figure switching service to be slow speed. In freight service we are all anxious to make maximum speed between stations, and it just depends on what you have got to do. The causes for the lever jumping out of the quadrant or jerking away from me are worn notches and dry valves. I am working in a bad-water district, where the water is treated and the boilers foam provided we do not keep them blowed and washed out. If the engine happens to be sitting around or drifting down a long hill and we have got a very dirty boiler and the injector
203 has not been used, the antifoam compound which we use loses its strength and lots of times I have had to raise the water until we could blow them out and get freshly treated water in the boiler. The alkali will rise with the water and come through the superheater unit and make a kind of dust that gets into the valves or cylinders and forms a white coating on the pistons, and it probably does the same thing in the inside of the valves, especially the cinders. Worn valve gear pins will also cause the lever to jerk or jump out of the quadrant, and there are a number of other things if I could just think of them (T. 840–843).

We handle the lever more in freight service than in passenger service because in freight service they generally handle tonnage trains, and, on account of the grade, it is necessary to adjust the engine on different levels of the road to maintain your speed, or get the tonnage over the hill. In going over a particular hill you would adjust the lever more times in freight service than in passenger service. In local freight we have quite a bit of picking up and setting out cars and also have quite a little of that in passenger service. I have been running mostly in passenger service and cannot tell you how many times we have to do that in freight service. In a passenger trip we probably have to handle the lever thirty to perhaps fifty times in 185 miles (T. 843–844).

I was injured by operating a manual reverse bar on June 1, 1930, near Amber, Okla., in passenger service on engine no. 1101, a 4–6–0 type, weighing about 168,000 pounds on the drivers. It is down grade from Amber to Chickasha and the train will roll almost all the way. I had eased off on the throttle and put my hand on the lever, making preparation to drop the lever down to a drifting notch, and it went to the corner and before I could turn it loose, my
203 finger was pinned between the pipe on the boiler head and reverse lever. The Government man and the roundhouse foreman told me there was three-eights of an inch clearance, but I do not think it was that much, due to the momentum of the lever when the lever went down and caught my finger, because I could not get it out. My finger was broken and mashed and I was off duty on that account six weeks. The company settled with me for $300.00. Someone had put an excessive amount of oil on the reverse lever latch. I discovered that after I was hurt. The quadrant is encased in a sheet iron casing, as a wind protection, and sits down in that casing where you cannot observe the condition of it. I afterwards discovered that there was no stop pin in the forward end of the quadrant. The accident happened at night. I had not at that time observed that the stop pin was missing. The engine had just recently come from another division and it was the second time I had had her (T. 844–846).

When I was on local service I have had as much as a month's experience continuously with one engine equipped with power reverse. This was ten years ago, and I do not remember the type of gear. I have handled our 1500's with power reverse—they are the best engines we have. From my experience with power reverse I have found that I have always been able to move them at will, with hardly any exertion whatever outside of one arm. With the manual reverse I generally always put my foot on the boiler head or some of the nearby appliances which are out in the clear (T. 846–848).

CROSS-EXAMINATION

I have taken the weights on drivers which I have given from a card bearing the heading "light weight without tender." I report thirty minutes before departing time at one end of our terminal and fifteen minutes at the other. During the thirty-
205 minute interval I oil the engine and inspect it. I inspect what I can see of the quadrant and reverse lever in the time I have at my disposal. On the night of June 1, 1930, the night I was injured, I cannot say I did anything other than just the hurried observation of the quadrant and lever on engine no. 1111. After the accident I discovered there was an excessive amount of oil on the quadrant. I did not put any oil on the quadrant between the time I reported and the time of accident. I also discovered that the stop pin in front of the quadrant was missing. I do not know

whether the pin was there when I left Oklahoma City. I have a hose with which to use hot water in washing off the deck and appliances on engine no. 1111. I made the measurements to which I testified, with reference to clearances, on engine no. 1102. The seat box on it is about twenty-four inches wide and twenty-two inches long. There is about three or four inches between the seat box and quadrant. I have an extra large seat box, and it is not the regular one which belongs on that engine. I did not put this wider seat box, which is twenty-four inches wide, on the engine. It is about fourteen inches from the seatbox to the brake valve. As to the amount of areaway between the side of the boiler and the outside wall of the engineer's cab, which the brake valve and its appurtenances take up, I did not make those measurements. We cannot go straight through there but have to turn sideways. I should judge there is about fourteen inches. We have a coil heater on the floor between the seat box and the front cab door, and a little platform on that right at the end of my toes, made out of one by threes. In front of that are a cylinder cock rigging, the engineer's independent driving brake release at my feet, and pipes which come down from the brake valve. It is fourteen inches from the brake valve back to the seat box. We turn to one side to get through (indicating by turning sideways through a small place) (T. 848–853).

206 The cause of the lever jumping out of the quadrant at the time of my accident must have been the excessive amount of oil on the quadrant, because I washed the oil off and put sand on it and had no more trouble. I took the train on to the end of the terminal. This quadrant sits down with a sheet-iron casing around it and you cannot see the top of it. I will also say that the engine was in a filthy condition, not in the condition it should be if the mechanical force had been keeping them clean, and it was harder to detect it on that engine until they got it cleaned up. We wash off the deck at the terminal but the roundhouse force keeps them clean. This was not in the deck; it was above the deck. This casing comes up flush with the top of the quadrant teeth. I am fifty-four years old (T. 853–855).

REDIRECT EXAMINATION

It is not part of my duty to clean dirt from the engine cab when I report. For my own convenience I clean it up sometimes and wash it out. The fireman is the one that does the cleaning if any is to be done. I have had only a few months' experience with power reverse (T. 855–856).

J. M. Crum, a locomotive engineer employed by the Chicago, Burlington and Quincy Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I am sixty-one years old and live at St. Joseph, Mo. I hired out as a fireman in 1897 and was promoted in 1902. I run from Kansas City to Omaha on a main line. I have had experience as an engineer in all classes of service, and at the present time I am running in passenger service. We operate S–1 and S–1–A locomotives which are a 4–6–2 type, manually reversed. The S–1's weigh 150,000 pounds without the booster and those with the booster 205,800 on drivers. We also have a K class of passenger engine, 4–6–0 type. The K–2 weighs 100,700 pounds, the K–1 92,900, the
207 K–4 121,400 pounds and K–10 121,900 pounds on drivers, all manually reversed. We have some of the K–1's in our territory at the present time. In freight service we have a class O and O–2 engines. They are the 2–8–2 types. The O–1's are 209,240 and the O–1–A's are 314,550. The O–1–A's, O–2's, O–2–A's, and O–3's are power reversed. We also have an R class of engines of the 2–6–2 type, weighing 151,000 and 152,000 pounds on drivers, manually reversed. In switching service, we have the following manually reversed engines: G–3 class, six-wheel switchers, weighing 122,500 pounds, but that was about twenty years ago and I have not run one for a long time. The R–4's and some of the R–5's are equipped with Stephenson motion, others have been converted to Walscheart valve gear. The K classes have Stephenson motion and some of them have slide valves (T. 856–860).

As to the occasion when we have to handle the reverse gear in going over a run from St. Joseph to Kansas City, our mileage is 135 miles. Going to Kansas City, I have five regular stops and one flag stop that I make about half the time. Returning from Kansas City to St. Joseph, I have four regular stops, one for taking water and three for railroad crossings. I estimate that I will unlatch the lever on an average, during this round trip, of about thirty times. The territory is river grade country. In through freight service I will handle the lever less over that particular territory. In local freight service it would be much more on account of picking up and setting out cars and spotting them at industries. In hooking up the lever in passenger service we place the right foot on the foot rest, which is usually attached to the front end of the quadrant, and brace ourselves and then grasp the lever and unlatch it to the desired position.
When you unlatch the lever it pulls first one way and then the
208 other. It rocks. The amount of force with which that rocking motion is accompanied depends largely on the engine and the condition of the valves and the snugness of all the valve joints in the valve gear. Some will handle very hard and some will handle comparatively easy. In my estimation the rocking motion is caused from the reciprocating motion of the valve. The motion of the valve transmits impulses to the valve gear and from that to the

reverse lever in the cab by way of the reach rod. There are other conditions which contribute to hard handling of the lever when you are hooking it up. New valve rings will make a great difference. When the engine foams it works off the lubrication and makes the engine harder to handle. I have had the manual lever get away from me while I was hooking it up. I was on a return trip from Kansas City, and after I got out about six miles and had my speed to where I wanted it I tried to get another notch away from the engine, and when I unlatched the lever it went down in the corner on me. I pulled it out of the corner and hooked it up. I was going to say that it was caused by the boiler foaming slightly, which made the valves dry enough so that it pulled the lever away from me. That, I think, was on a S–1 engine about a year and a half or two years ago. Last fall on a K–1 engine the lever went down in a corner on me. I was sitting on the seat when it happened. That was caused on account of oil that got on the quadrant. I have had that happen a good many times in my experience. Some of the engineers put oil on the ratchets so that it will handle better. I was never injured in hooking up a manual lever.

I was injured by a manual lever on November 21, 1928, at St. Joseph. I was stopping for one of the three railroad crossings about a mile from the Union Depot, running in passenger service with a S–1 booster engine, no. 2830. I had applied my brake preparatory to stopping for that railroad crossing, and I kicked the seat
209 down, and was standing, and when I got up pretty close to the crossing, my speed was down to about 15 miles an hour. I shut off the throttle and put my hand on the reverse lever and shoved it down full forward motion. I never got away from the lever at all. It came right back and smashed me in the right breast. It did not knock me down, but I landed on my feet in the deck of the engine. I did not lose any of my faculties, but I had a pretty hard time getting my breath for a little while. I pulled the train into the station myself. I was off duty on account of that injury nineteen days, and the company paid me $176.86. Prior to the accident the engine had not been lubricated for some little time. We were having trouble with the lubrication of the valves. It had a Detroit force-feed lubricator (T. 860–867).

I have had about two years' experience with Barco and Ragonett power-reverse gears. The reverse lever in the cab used on the Barco is about two feet long I would judge, although I have never measured it. It is set in a quadrant, the front end just to the left of the engineer. The lever is connected to an operating air valve by a reach rod. The air valve admits air to either end of the cylinder, which in turn, transmits power to the reverse gear by which you are enabled to place your valve in either forward or back-up motion and control the cut-off. The Barco transmits the power to the valve motion through a worm gear. I have never had the Barco gear to creep. I have never had any trouble whatsoever in reversing an engine with power-reverse gear. It requires only a minimum amount

of strength to operate the power gear. I have not had any experience of any jerking of the lever in the cab. Regulating the cut-off on power-reverse engine is much easier than on manual-reverse engine. In practice there would not be any difference in the number of times that you would adjust the lever to accomplish the cut-off as between hand and power reverse. On the engine that I run,
210 they replaced the Ragonett gears with Barco gears. The Ragonett got in bad shape and got to creeping bad about six months before the engine was taken away from me. I have had about six months' experience with the Barco. As to my ability to keep a look-out with power reverse, the gear handles so easy you can grasp it and give your attention to most anything else while you are adjusting it. When I operate the hand reverse I generally give all my attention to it for the time being (T. 867–872).

CROSS-EXAMINATION

I have been an engineer since 1902, and the injury when the lever struck my breast is the only injury I have experienced. The Burlington Railroad is continually equipping its engines with power reverse and is making progress in substituting power gears for hand gears. Each year there are more of the power gears in use on the Burlington. As to the creeping on the Ragonett gear which was taken off the locomotive I mentioned, my experience with it was that the engine would gradually get to working harder and sometimes I would overcome this by easing off the throttle, pretty near shutting it off, and it would back itself up again without touching the reverse lever at all. Easing off the throttle would take the strain off the valve and permit it to hook itself up easier and quicker. That was the result of the piston in the air cylinder of the power reverse mechanism not maintaining a fixed position while running, and was on account of a variance of the pressure on either side of the piston in the cylinder, which of course will allow the piston to go one way or the other. The pressure is supposed to be the same on both sides. That was in the passenger service. I do not remember how long I had the experience of creeping with that gear. It was not a matter of several months. They finally overcame it by a few repairs I suppose. This particular engine still had that particular gear
211 on it when the engine was taken away from us. This is in a passenger pool and we have three different engines. They took off the S–3 engines and gave us three lighter engines with boosters in place of them. The booster engines were manually reversed. When I said a while ago that I had an engine with a Ragonett gear which was in bad shape, creeping, and that they gave me a Barco gear, that was engine 2951. The no. 2962 was the one which had the gear, one which bothered me about creeping. They changed the gear on the no. 2951, taking off the Ragonett and putting on the Barco, but not on the no. 2962 (T. 872–876).

In passenger service we would run the greater part over the division with the reverse lever practically on center. It depends on the size of your train. Sometimes we won't get the lever in the last notch for a long time and sometimes not at all during the trip. The run which I have now, ordinarily four cars to Kansas City, I work the engine at the shortest possible cut-off and then throttle it down to keep it from exceeding the speed limit (T. 876–877).

I was injured on a S–1 engine equipped with a booster. Previous to the time I went on this run, which was about three and one-half years ago, I ran an S–1 engine for three and a half years straight. I have been operating manual-reversed locomotives for twenty-eight out of my thirty years of service as an engineer. The S–3 engine is the largest I have ever run in my experience. It weighs 180,800 pounds on drivers. I ran that class of engine for about two years. I occasionally ran engines between the S–1 and S–3 types. I have been in passenger service about fourteen years and practically all the time have used S–1 and S–2 engines, which are relatively light. In passenger service you will hook up an engine maybe three or four times after you start out before you get it up to the working notch (T. 877–879).

212 REDIRECT EXAMINATION

The experience I had with the Ragonett creeping was about a year and a half ago (T. 879–880).

J. J. ROGERS, a locomotive engineer, employed by the Chicago, Burlington and Quincy Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Alliance, Nebraska. I was hired as a fireman in 1905 and promoted to engineer in 1909. I am employed on the Alliance Division where the territory is partly valley and partly hilly, and in addition on a subdivision known as the Black Hills District. I have had experience in freight, passenger, helper, and switching service. The locomotives in our territory are about the same classes as witness Crum described, with the exception that we have two classes of leased engines from the Colorado & Southern manually operated (T. 880–881).

Under normal conditions it requires a considerable amount of strength to reverse the manually operated engines with which I have had experience. If any condition should arise above normal, it would require all the physical strength you have. We have conditions which I call above normal. In handling the manual lever on heavy work I put my right foot on the foot brace. The reverse lever is somewhat ahead of me toward the boiler. I take a firm hold of the lever latch, which is attached to the top of the reverse lever, and give the lever a reasonable jerk to pull it back. As to any experience I have

had with the lever jerking out of my hand or pulling me, it depends on the volume of steam remaining in the cylinder, and according to the pressure in the valve chamber. Sometimes the steam binds the valves and then it is sometimes impossible to pull the lever back.

213 The causes which I have experienced that would make the lever pull hard are engines new from the shops, tight bushings and links, tight fitting links, new valve bushing, the reach rod binding on brackets, weather conditions, such as dust storms blowing dust in between the links and causing them to drag. In the winter time the oil congeals, that is, in excessive cold weather, and it freezes on the surface between the links. This happens from zero and below. It depends on how damp the atmosphere is. We have had that kind of weather frequently in my territory. Frequently frost will also accumulate on the surfaces of the links. To relieve this situation I generally pour a little kerosene oil over the link blocks to free their movement (T. 881–884).

Two engines are usually being worked on each shift at each end of our yard. Most of our work is what we call grouping. By this I mean the cars are switched and interchanged from one track to the other until they are grouped together and then placed on the train in station order. On the west lead the work is somewhat lighter. The grade is not so steep. On the east lead the grade is slightly uphill and therefore requires more care to kick the cars from the west lead. On the west lead it all depends on the switching list as to the way and the condition in which the cars come in, but sometimes it requires twenty to forty movements of the lever in one hour. That would be the usual condition during our trick of eight hours. We do not have much lost time, when our engine is standing still, with the exception of twenty minutes for lunch. In some cases when train no. 80 arrives in Alliance, it is given the strictest consideration to be expedited in the switching movement, so while the car inspectors are inspecting the trains the engine foreman and the yard foreman go along the train and bleed the air off the cars. During this period a locomotive may stand from five,

214 ten to fifteen minutes. Sometimes we have four cars or more of stock which have to be taken over to the feed yard so the car inspector will inspect these cars and release the blue flag so the engine can be coupled on the cars and be taken over while the rest of the train is being inspected. I have had experience in local freight service operating R–4 engines. The first stop would be Berea, Nebr. Sometimes we would have some light switching there. It would average fifteen to not over thirty minutes in the busy season. During that period I would estimate we would have ten to fifteen movements of the reverse lever. Our run is 111 miles long. All told we have seven stops where switching normally occurs. Our run varies from ten to sixteen hours (T. 884–887).

I have had experience on the Black Hills Division with K–1, K–2, and K–10 manually reverse engines. The K–1 and 2 are ten-wheel engines, weighing about 92,900 to 100,700 pounds on drivers. These

engines handle harder than the piston valve engines because they have slide valves. I compare the handling of them with R–4's, weighing 151,000 pounds on drivers, which have piston valves. I attribute the fact that they work harder due to the designing of the valve which causes sliding friction. These ten-wheel engines I described have Stephenson motion. I have noticed a considerable difference in the handling of a Stephenson motion engine compared with one equipped with Walscheart motion if the weights on drivers were approximately the same. I should judge the Walscheart motion handles at least 10 or 15% easier. The reason for that is the difference in the position of the link motion. When you change the cut-off or reverse engine with Stephenson gear you either raise or lower the links. With the Walscheart gears you just raise or lower the link block. The link is stationary on the link frame, although it oscillates in trunyon bushings. The link is usually heavier than the block (T. 887–889).

215 I was injured in handling a manually reversed bar on March 3, 1930 in the yard at Alliance, Nebr., while handling a G–H switch engine, no. 1750. I was completing the switching movement on train no. 80 and I think I had hold of ten cars pushing them ahead of the engine. My engine foreman was riding the foot board guiding me up to make a coupling on the rest of the train. As I received the stop signal, my engine was still on the lead, about on the switch where the diversion is made from the switching lead to the track where train no. 80 was being made up. The engine foreman gave me a proceed signal, and I opened the throttle wide but my engine would not move. He immediately gave me a back-up signal for the purpose of taking the slack. I closed my throttle and reached for the reverse lever and gave it a reasonable jerk, but I was unable to reverse it. So I braced myself again and tried it again, and I applied all of the strength I had. At this time my hand slipped over the top of the reverse lever, over the latch, and I fell backwards in a sort of a zig-zag position. It seems as though my body had rubbed against the side of the cab where the window sash is, and then I fell towards the boiler head and against the brake valves. I got a severe pain in my hip and my back. I was delayed in the movement of taking the slack and my engine foreman came to my cab window and asked me if I could not back up. About three days later I found what my injury was. I was told, the first day, on stopping at a chiropractor doctor, but did not take any treatment from him on this day. He said I had a slipped vertebrae and a displacement of the sacroiliac articulation, which was the wedged-shaped bone in my hip. I was off duty nine days, but my hip continued to bother me for perhaps six months until the pain gradually worked down (T. 889–891).

216 I have operated Alco, Barco, and Ragonett power reverse, but have had more experience with Ragonett than with the other. Since 1912 or 1913 I should judge two-thirds of my time has been with power reverse. I have never had a power

reverse gear which would not reverse the engine, except I had one break during that period. I judge that was in the year 1926 or perhaps earlier. The piston rod broke off even with the cross head and caused my link motion to drop down to the full end of the stroke. I was running at full speed into a siding at the time. When I first discovered that something went wrong with my valve gear, it had the same effect on the exhaust as the creeping effect, which created a louder sound for the amount of steam that the valves were getting at the cut-off. I blocked up the gear by means of taking an old block and judging the distance of the link travel where the engine would handle the train without any interruption, or reversing or shifting, I got away without any delay and took the train into the next terminal.

I have had experience with power-reverse engines on local freight runs and never had any difficulty in maintaining the cut-off with it. I have not been injured in handling power-reversed gears (T. 891–894).

CROSS-EXAMINATION

In counting the number of separate operations that I testified to, I was not counting each time I moved the lever a notch or two, but was counting the reverse movement back and forth each way. When you start the engine, and as you gradually pick up speed, you move the lever a few notches at a time and each time you move the lever you count that as one operation. Yard service varies. For instance, I am assigned to this one yard in which they have no engine on the east end. A train comes in with eighty cars. There is an extension of three tracks beyond the length of this train, which would
217 hold about 150 cars. For this reason when we finish our work on the west we go to the east end to finish the head of the train. We have cars from the rear that are interchanged to be placed on the head of the train. Ordinarily in yard service you do not do much hooking up with the exception of the movement that I have explained. I would want the cars to run down with their own momentum, and I would hook the engine up about once. The switching in connection with local freight service does not require much hooking up. The movement would be slow, similar to yard service (T. 894–895).

On the occasion when I wrenched my back and hip, the resistance to my pull was due to the large amount of steam pressure in the cylinder. The reason I did not reduce the steam pressure by opening the cylinder cock was that I was afraid of burning the engine foreman. It would be possible, to a certain extent, if I had that situation again, to warn the man or else wait for a half a minute or a mintue until the steam pressure was reduced. If I should open the cylinder cocks, the emission of steam would really destroy my vision and the man would be invisible to me for possibly a minute. This causes serious delay. It also blows the dirt away from where the switchman walks along the tracks, and may blow out a switch light.

For several reasons I did not open the cylinder cock. As another reason, the steam usually, when you shut off the throttle, will decrease itself after a lapse of five or six seconds to such an extent that with an ordinary pull you can reverse, and upon the influence of my engine foreman, hurrying me along with the back-up signal, I possibly acted a few seconds too soon. The steam pressure would have reduced itself possibly in three or four seconds (T. 895–897).

I stopped at the chiropractor's office, at the time of my injury, but did not get any treatments from him then. Later I got some
218 treatments from him. The first person who treated me was an osteopath. One of the doctors gave me a prescription for some pills. My hip was the point of my body which came in contact with the boiler when I slipped. One of the doctors held me down on the table while the other put my leg up in this position, almost up to my shoulder. Then he turned my leg down and gave it a severe jerk as if I had jerked on the reverse lever. Then I felt something click in my side and I could hardly stand the pain—it was torture to me. The pain had not settled for about six months. I could still feel the effects of it occasionally through my back. After that treatment the pain settled to my knee. Then they repeated the operation and did it over (T. 897–899).

REDIRECT EXAMINATION

In practice I have found that I could not wait to empty the cylinders of steam in switching service without being criticized. The yardmaster does not want us to use that practice. If the engine stands near his yard office, at a distance of probably ten car lengths, he will come right out and call us to close the cylinder cocks (T. 899–899).

Otto Inglett, a locomotive engineer employed by the Atchison, Topeka and Santa Fe Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Fresno, California. I went to firing on the Santa Fe in 1903 and was promoted to engineer in 1909. I run from Calway to River Bank and have had experience in through freight, passenger, and local service. We have the following types of manually reversed locomotives: In freight service, a No. 439 class, 4–6–0 type, weighing about 123,000 pounds on drivers; a No. 464 class, with the same wheel arrangement, weighing 119,600 pounds on drivers; and a No. 1239 class, 4–6–2 type, weighing 162,700 pounds on drivers. In
219 passenger service, all the locomotives on our division are power reversed. In yard service they are all Stephenson motion, six-wheel switchers, weighing about 125,000 pounds on drivers. The No. 400 of the 439 class and the 18 class which is the small engine, have slide valves. Almost all of our manually reversed engines are Baldwin locomotives. We also have two Rhode Islands on the local on which I work (T. 899–902).

On the Baldwin locomotives, the clearance around the manual lever between the quadrant and the boiler, I should judge, is about three or four inches. When the lever is in back motion the amount of clearance between it and the back board of the cab depends on the class of engine. The one I have is a Rhode Island, and it is practically a foot from the back end of the lever to the back end of the cab. On the 501 and 502 they have to cut a hole out for the man to get back there. I was injured in handling a lever on that class of locomotive due to lack of clearance at rear motion. On the 501, when I reversed it, I caught my elbow against the back of the cab. There are no other places where the clearances are close on the 500's. On the 1,200 compounds, when you get them in back motion you cannot get in on your seat box. I got my toe pretty nearly mashed with a 501 in reversing it because the reach rod is so close to the floor in the back motion that if you get your feet under it, it will mash them (T. 902–904).

As to the amount of strength that it requires to reverse our manually operated engines, the 1,200-compounds are very hard to reverse. At times the others are hard to reverse. When you have your piston valves full of steam they are hard to reverse. Most of these locomotives have a foot brace which I use. On those which have no foot brace you get your foot up against the window frame or against the supply pipe of the right injector. With my foot braced in that fashion, either on the foot brace or against the supply pipe, the lever pulls hard. You have to brace yourself so you have more strength and more power (T. 904–905).

I was injured in attempting to reverse a manually operated engine at Corcoran, Calif., on May 25, 1929, with engine 441, which weighed 123,000 pounds on drivers. I made a drop of some cars, and the engine worked water, and when I went to reverse it I gave a hard pull on the lever and strained the muscles of my arm and shoulder. The lever was in forward motion and I went to reverse it in the backward motion, but could not cut her back. I just braced myself and pulled the lever and I felt the strain, and that was all of my work that night. The fireman relieved me of duty. I was off five days.

I have experienced strains on other occasions. I have with the engine I run now. Throwing the lever in back motion at times strains me, and once I thought I was ruptured. I just felt a severe pain down in my groin and I laid off a trip to go to the doctor to see about it, but I was not ruptured. The doctor said there was a very severe strain down there and almost a rupture (T. 905–907).

In my experience the causes which make the lever handle hard and give me those jerks are dry valves, engine foaming, link blocks, and links too tight, or new rings in the valve chamber. On one occasion the reverse lever went to the corner when the valve ring broke and went into the port. I have had only three months of experience with power reverse of the Alco type and have had no difficulty in handling it (T. 907–908).

CROSS EXAMINATION

I have been pretty constantly in service as an engineer since 1909 and only about three months of that time I have handled power reverse. In the case which I mentioned where I mashed my toe under the reach rod, it mashed the end of my toe and cut through my shoe, injuring the toe a little bit but not enough to lay off or
221 anything. I reported it as an injury but did not lay off. The reach rod is above the floor, but when it is in back motion it is within a half inch of the floor.

By Mr. ALDERMAN:

Q. It is not necessary for you stick your foot under the reach rod, is it?

A. If you are switching if you are not careful I don't know how but that you will get it there anyway, because the space is so narrow. You have to stand up to reverse them in the back motion.

The narrow space I refer to is between the quadrant and the side wall of the cab, a space, I judge, of about sixteen or eighteen inches. The seat box sits back at the end of the quadrant and that gives me just room for my feet. We stand up to reverse the engine. I also testified that I caught my left elbow against the rear of the cab when I was reversing the engine. I was sitting on the seat box, facing the front of the cab and was operating the lever with both hands; as my left arm came back I hit my elbow. I did not lose any time with it, but it hurt. I would say it hit my " funny-bone ". On the next occasion to which I testified, I said I had sprained my arm and shoulder and laid off five days. I reported that as an injury and had medical treatment. The doctor gave me a liniment to bathe my arm and shoulder with. On that occasion the engine was working water and had a dirty boiler. On the last occasion which I described, I said I threw the engine into back motion and felt the pain and thought I was ruptured, but found I was not. I laid off three days on that occasion, a round trip and a Sunday. I do not remember the exact date when this occurred but it was along about the last of January or February in this year at Calway, California.

I had experience two or three months ago, with power reverse
222 gear on passenger work. I did not have a failure in those three months with the power gear. I reported the occasion when I thought I had the rupture to Doctor Sweeney and the general foreman. I was using Alco power reverse and had no trouble with it creeping. I am fifty-seven years old (T. 908–913).

E. L. BARTON, a locomotive engineer employed by the Northern Pacific Railway, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Minneapolis, Minn., and am 47 years old. I was hired as a fireman on the Northern Pacific in 1901 and promoted to engineer in 1905. I run on the St. Paul division, extending from St.

Paul to Staples. My experience has been mostly with freight, transfer and yard service, very little passenger (T. 913–914).

In freight service we have the following manual-reverse engines at the present time: Class W, W–1, and W–2, 2–8–2 types, weighing 207,000 pounds on drivers. Also a smaller engine, class X, a 4–8–0, 146,200 pounds. In passenger service we have some Q–1's and Q–2's, 4–6–2 types ranging from 144,000 to 153,000 pounds on drivers, manually reversed. In switching service we have the L class, manually reversed; a six-wheel engine weighing from 94,000 to 150,000 pounds on drivers. The class W, X, L–9'2 and L–10's have Stephenson link motion (T. 913–916).

At the present time I am in transfer service running from Minneapolis to White Bear, a distance of twelve to fourteen miles. I handle the reverse lever fifteen to twenty times in running from Minneapolis to White Bear. When I arrive at White Bear I put the train away and switch it out, handling the lever about fifteen times. The next movement is to make up our train for the return trip, which takes an hour to an hour and a half. I judge
223 I handle the lever about fifty times in making up the train.

Then we return to East Minneapolis with the train, handling the lever ten or twelve times. Upon arrival at Minneapolis we set out part of our train and take the remainder to the lower yards, which involves six or eight operations of the lever. At the lower yard we leave the balance of the train and return to the round house, which requires four or five operations of the lever. We have other transfer runs, and in a general way the number of times we are required to handle the lever is about the same as the instances I have given, possibly a few more or a few less. We use the class W engine in transfer service (T. 916–918).

As to how the lever handles when I am reversing the engine during any of these switching movements, I will have to place that in three different classes: Hard, medium, and some of them easy. The hard-handling engines are usually those which come from the shop after being repaired. They require considerable strain in reversing them. Those that have been out a while, some handle fairly hard, and the others of the same type fairly easily. We have to hook up the lever on these transfer runs. With this class of power the lever sits besides the seat box. I place myself with my foot against the boiler head to hook up the engine. I have not noticed difficulty with the lever jerking much in transfer service because our speed is not very fast. I have also had experience in road freight service. At times when the valves become dry or the reverse lever latch worn, I have had the lever start to work toward the corner. We have some very cold winter in our territory and that makes the lever handle much harder. Frost accumulates around the links and eccentrics and any leak that would run under the jacket, or leaky water plugs which would leak water down over the eccentrics or links, would

cause them to freeze up and make the engine handle hard (T. 918–920).

224 I was injured in handling a manual reverse bar on May 15th, 1929, on engine no. 1578, a class W engine, on a work train at Darling gravel pit. We were switching out loads and empties and while making a reverse movement in back-up position, when I pulled the reverse lever back to the back end of the quadrant, I strained the muscles or ligaments in my back. The lever started fairly easy, but seemed to catch just before it got to the back corner. The fireman did the remainder of the switching for me. I was not able to do it. My back became worse by the time my run was finished, and when I arrived at Staples the fireman helped me off the engine. I reported the accident to the roundhouse foreman, that I had injured my back in reversing the engine and told him it would be necessary for him to get a man to take my place. The fireman assisted me over to the depot where I took a passenger train back to Minneapolis. I laid down on a seat in the day coach and when I arrived at the junction point at Minneapolis, where I was to get off, I could not raise up. The conductor and brakeman carried me out of the coach. They got a stretcher and some men at the yard took me home. I was off duty on account of that accident fifteen days. I was released after ten days and the company paid me $85.00 (T. 920–922).

I have had about two and one-half years experience with Alco and Ragonett power reverse, both in yard and transfer service. I found them to operate much easier and faster than manual reverse and they did not take my attention away from my work while operating them. In taking signals I could still keep on looking out along the train, outside of the cab, without turning in the cab to make the reverse movement. With manual reverse it is necessary to take my mind off my signals and turn into the cab to make the reverse movement.

225 It is much quicker and easier to take slack with power reverse than with manual reverse. If, while making a reverse movement with the manual bar, the slack should run out in the train I would possibly have to make the second reverse movement, whereas with power reverse I could have the movement made before the slack would run out. I have never had any difficulty with the power reverse becoming inoperative in the winter or at any other time. I have never been injured in operating a power reverse gear (T. 922–924).

CROSS-EXAMINATION

I have had about twenty-three years' experience on hand reverse engines and two and a half years' experience with power reverse. In dividing the locomotives into three classes, as to the difficulty of handling the reverse gear, I said that the hard class applied to some of the engines which have just come out of the shop, and the medium class included those which had been out of the shop for some time and some which would not handle as easy as others because of reach rods dragging against the brackets. That is a question of adjust-

ment—they would have to make a change in the bearings or brackets. I report situations like that and in the majority of cases get prompt action, remedying it. The classes which operate easily are those that were more worn. They operate easily when they have plenty of play on all bearings. As to how long an engine has to be out of the shop before it ordinarily gets over the first stage, there is a difference. Some will loosen up in two or three trips and some of them will take a month (T. 924–926).

On the occasion when I was injured, I was sitting facing front when I undertook to reverse the lever. I was switching and my work was in front of me.

"By Mr. ALDERMAN:

"Q. How far behind you would the lever extend in the extreme reverse position on that engine?

226 "A. Well, about back about here [indicating].

"Q. When you say in that position, Mr. Barton, is your back against the wall of the cab, the back of the cab?

"A. No.

"Q. In other words, you could have leaned back further?

"A. I could not have gotten her further back.

"Q. You could have leaned back as far as the extreme back position?

"A. I would never have had a chance to brace my foot on the boiler if I had. I would have been too far away."

I should judge there is about six inches between the quadrant and the seat box. In reversing the engine I have quite often faced toward the quadrant. It is not easier to reverse the lever when I am facing it than when I am pulling it past my side. I wouldn't have an opportunity to brace myself. The position in which I was sitting when I exerted the effort may have had something to do with my injury. The lever started easily and then stuck, and when it stuck was when it wrenched the muscles in my back. The strain that was applied to my muscles came from my own exertion rather than a movement of the bar. I could have gotten up from my seat box and moved around on the outside of the lever and possibly thrown my weight against it. It is not practical to do that though. In switching ahead it would be more convenient to work in the position that I was working in. I did not give it a sudden jerk as it stopped. I wrenched my back as soon as the reverse lever stopped or stuck. It was a straight pull on the lever. I applied very little extra effort when it struck. After starting, it came a little easier my way until it got to the point where it stuck, and when it got to that point I applied more power to try to get it past. There wasn't much difference in the power of the pull from the time I started it until I strained

227 myself. As it stuck I strained myself in getting it back. It was about 9:30 in the evening when I got home and I called the doctor the next morning. He worked on my back and gave me a prescription for liniment and I used the liniment on it. There were

two days that I could not turn over in bed and I had to have assistance. That is the only injury I have received in the twenty-three years I have been handling manual reverse levers.

The lever was just forward of my left shoulder, about opposite my left shoulder, when it caught. It had not gotten to the extreme reverse position and had possibly four or five notches to go. I remained seated on my seat box while I was doing that. It is customary for me in that service to remain seated on my seat box in throwing the lever in reverse position in switching ahead. From that position I can observe the signals ahead. What I said about having to take my eyes off the men who are giving the signals, when using a hand lever, applies to switching in the rear. It also would apply for signals ahead along the train when it was necessary to bring my head right back inside the cab in order for me to make the reverse movement. We have cases in which we would have to stick our heads outside the side window in order to receive the signals ahead when switching. In effect, my testimony is that you can see part of the signals when you are switching ahead through the front cab window. That is, where a man is right at the front of the engine you can, but if he is down alongside of the cars it is impossible to see them without having your head outside the window. In that case in forward switching you do not have to change your position other than to lean outside the side window (T. 926–932).

J. J. ROGERS, was thereupon recalled as a witness and having been previously sworn, testified further as follows:

228 The purpose of the reversing gear on a locomotive is to change the direction of movement against the resisted force. It accomplished that by shortening the cut-off through the mechanism of the valve gear. What the reverse lever does is to move the reach rod which is connected to the valve gear, and the valve gear through the link moves the valve which controls the admission of steam to the cylinders. By changing the position of the valve by means of this gear and reach rod, you determine whether the steam is to be admitted to one side or the other of the piston. That is, if you are going in one direction and want to reverse the engine, you would stop, operate the reverse lever, and that would change the valve so as to admit steam to the opposite side of the piston to what it had been when it was going in the other direction. The reverse lever works upon a principle similar to lifting or lowering weights, compressing springs and overcoming frictional resistance. When you move the reverse lever the tumbling shaft is stationary, being mounted on the frame between both sides. It has two tight-fitting bushings, an oil hole on the top where a drop of oil can be inserted to lubricate it, causing a free movement. The tumbling shaft has a small rod which leads to the counter-balance spring. The counter-balance spring is located and mounted on an accessory bracket beneath the boiler. This has an adjustment for the proper

compression, balancing the weight by the reverse movement of the part. From the tumbling shaft to the valve is connected a rocker arm to the link block with a Stephenson gear. This is stationary, although it has a tendency to operate the valve when the links are raised or being lowered. It moves the position of the valve. The valve admits steam, we will say, for eight inches of the stroke, and then the port is closed for the rest of that stroke, and you use the steam expansively. In other words, what you do with the reverse lever is ultimately to change the position of the valve down in
229 the steam chest. That means to change the relative position in the motion. The valve is changed by a mechanical force coming from the drivers and is in constant motion when the engine is in motion. The reversing gear performs two distinct functions; first, to change the direction of the engine; and, second, to lengthen or shorten the stroke of the valve; that is to say, to vary the portion of the stroke during which you admit steam to the cylinder through the port opening. It is about the same condition as an automobile starting in low gear and shifting into second and then into high. The purpose of the arm that extends from the tumbling shaft to the counterbalance spring is to equalize the link on the Stephenson gear. When there is no steam in the cylinder the reverse lever should come back with ease as well as go into the forward motion. The spring is compressed and overcomes the difficulty of the weight of the movable parts of the valve gear which have a tendency to pull in one direction. You have to get under the drivers to make an adjustment of the counterbalance spring, and I would not want to do that while the engine is in motion. You have various oil holes and places to oil about the links and reach rod connections and all the various parts where there are bushings or connections. As to whether the counterbalance spring is always kept in such adjustment as will accomplish the balancing of the parts, I will answer that it usually is, but we have a long bolt, about two feet long with threads on it for the purpose of adjustment, and a grip nut to keep this stationary. From the vibration and the jarring of the locomotive this nut sometimes comes loose and causes the counterbalance spring to expand itself. For this reason it will cause the mechanism to work harder in one direction or the other. When I first discover this I report it to the roundhouse, but the first indication is by the reverse lever. The minute I get ahold of the lever I can tell
230 most anything that is going on. You can tell most anything that is going on with your valve mechanism, or your counterbalance spring, or the valve itself, by the way the lever acts, and one more proof is by the cut-off. The exhaust through the smokestack is the final proof; it beats it one, two, three, four; one, two, three, four. They are just as square as anything you can refer to when the valve is square and you have the engine in the proper hook-up notch (T. 932–940).

HARRY LOWE, formerly employed by the New York, Chicago, and St. Louis Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Peru, Indiana. My occupation is that of a farmer. I formerly was a locomotive engineer and fireman on the Nickel Plate. I was hired as a fireman in 1912 and promoted to engineer in 1920. I performed my service on the Indianapolis division between Indianapolis and Michigan City. I ran on the extra board, off and on until 1928, and then went to running in freight service between Indianapolis and Michigan City. I was using a 2–8–0 engine, weighing between 180,000 to 200,000 pounds on drivers, manually reversed, with Baker valve gear (T. 940–943).

On April 20, 1928, I was backing up from Michigan City to Argos, with locomotive no. 383, one of the consolidated engines I have described. We had been backing up for about nine miles, when we neared Dillon, Indiana, approaching an interlocking plant of the Wabash Railroad. I was sitting, looking backward, with my left arm on the arm-rest and my right hand resting on the top of the reverse lever. The locomotive was moving between fifteen and twenty miles an hour. It was a light engine. The reverse lever was in backward motion about half stroke. That would place the lever about half-way between center and full backward motion. I had observed a Wabash train on this crossing, and as we were approaching the crossing I was watching the train to see if it would
231 clear the interlocking plant, so that he could give me the interlocking plant without having to make me stop. The engine was backing up, but I was looking out ahead; that is, I was looking ahead the way we were going, but it was backward to the engine. I had my left arm on the arm-rest and my right hand on the lever. As I saw the Wabash train passing over the interlocking plant the signal was at stop, except the distant signal, which always stood at caution, and we had either just passed the distant signal or were right under it when I noticed that the Wabash train had cleared the interlocking plant, and I turned around to see if he would give us the home signal.

"By Mr. STEVENSON:

"Q. What was the next you knew?

"A. The next I knew I was lying in the gangway with the fireman bathing my face with cold water.

"Q. When you were in that position, what was the first thing you noticed or what was the first thing you knew?

"A. The first thing, I noticed the escape of pressure, which I took to be the pop valve. I had a new fireman. It was his third trip. I asked him about the water in the boiler. And I asked him to put the injector on to satisfy my mind that there was water in the boiler. While he had his injector on I noticed the steam gauge and noticed

it was not the pop valves that was causing this escaping pressure. So I told him he could shut off his injector. I also noticed then that the air pipes on the back boiler head was cut off, and that is where the escaping pressure was found. It was from the air from those pipes. I also noticed that the reverse lever was laying in the tank.

"Q. Do you know where your locomotive was standing with reference to the track and the crossing?

232 "A. It was standing about 200 feet from the home signal outside of the interlocking plant.

"Q. Were you on the rails or on the ground?

"A. We were on the rails.

"Q. In what condition were you?

"A. Well, I knew as to one part of it. I knew I had both arms broken, but otherwise I didn't know any exact locations except I knew I had both arms broken. That was on account of the way they lay that I knew they were broken.

"Q. What did you do under those circumstances?

"A. I asked the fireman to straighten my arms, which he did. He started to just pick them up, and I asked him to pull them over straight before my head and hold them out straight while he laid them down by my side.

"Q. Did the fireman do anything else for you?

"A. He moved them at different times when I thought by moving them would reduce the pain some. And he also helped me to find out if I was hurt inwardly, too. I thought of my folks. I asked him to press down on my chest to find out if I was hurt inwardly. I wanted to tell my folks how I was hurt. So he pressed down on my chest, but I could not feel any pain. He squeezed my side, and there was still no pain. And I told him what message to send to my folks at home.

"Q. What happened to you then? Where did they take you or where did you go?

"A. Well, they came after me with an empty caboose from LaPorte and took ~~me back~~ to LaPorte, to the hospital at LaPorte. They brought the doctor with them on this engine and caboose.

"Q. What did they find as to your condition?

"A. They found at that time both arms broken.

"Q. At any other time did they find anything else?

233 "A. Yes, sir. That was on Friday evening. Saturday at noon they found I had my leg broken. Monday morning they found I had a dislocated shoulder.

"Q. Which shoulder?

"A. The right shoulder.

"Q. Will you describe the conditions in the cab of the locomotive with reference to the position of the quadrant and the location and moving radius of the lever?

"Examiner ROGERS. Before the accident?

"Mr. STEVENSON. Yes, sir.

"The WITNESS. The quadrant is behind the boiler to the left of the engineer's seat box. It extends back past the engineer's seat box almost to the back board in the cab. When you reverse those engines in full backward motion the top of the reverse lever extends back into the gangway between the cab and tank, that is, between the cab and tank.

"By Mr. STEVENSON:

"Q. How close was the quadrant and lever to your seat box?

"A. On those particular engines they are rather close. I could not give you the exact clearance, but they are just about enough to clear a man's leg. If he stands with one foot beside the seat box he can get the lever by, but it will brush his clothing in going by. His leg will be between the seat box and the quadrant.

"Q. In getting on to your seat on the engineer's side could you do that and avoid the quadrant or the plane of motion of the lever?

"A. You cannot get on to the engineer's seat box without crossing over the quadrant."

When these locomotives were new they were equipped with Stephenson valve gear. Prior to the time of the accident I
234 do not know the exact clearance with the lever in full forward motion with reference to the backhead of the boiler and the appurtenances. There was some clearance. I ran one of those engines from March 15, 1928, to about April 20, 1928, and fired them for a period of eight or nine years prior thereto. I observed the practice of the engineers on those locomotives when I fired them, when they were engaged in switching service. Their practice in handling the lever was to step over the quadrant on the left side of the lever, putting their foot against the boiler head and pulling the reverse lever back, stepping back over the quadrant and proceeding to do their work in whichever direction it might have been. My practice was practically the same. I did that because it was much easier to handle the engine. I had engine no. 383 the night before my accident and took it from Peru to Michigan City with a train. I had occasion to use the reverse lever on that trip, and the locomotive and lever operated as well, or maybe a little bit better than the average engine. I had occasion to observe the lubrication system and that engine had a peculiarity. The cylinders and valves would groan, even though they were lubricated and showed lubrication on the pistons. It would still groan as if it had dry valves and dry cylinders. As a rule groaning of the cylinders indicates dry valves and cylinders. On my trip on April 20th, the evening they called me, I went to my engine and they had filled the lubricator but they had left the oil in my valve oil can. I asked the foreman if he would get me some more oil as I did not like to leave with no oil in my valve oil can. He gave me two pints of valve oil. On that particular trip my lubricator was working perfectly out of Michigan City and also at LaPorte. I observed them both at Michigan City

and LaPorte. But I had not observed them between LaPorte and where my accident occurred (T. 943–953).

235 During my services as a fireman, I had occasion to operate the lever under different circumstances. Sometimes it was on days where we would have switching for maybe an hour or an hour and a half at a time in the afternoon, which would put the sun on the engineer's side, and on a hot day the engineer would ask me to handle the lever awhile so he could get his breath and cool off. I have had occasion to help the engineer with the reverse lever several times. That would be in case the lever would jump out of the quadrant and go into the corner and we would have a hard handling engine and an old engineer. He could not handle the engine in cases where we would have a hard handling engine. We have had engine no. 5501 but she is not on our division now. One time with that engine we were on passenger service, although the engine was a freight engine, but they did not have a passenger engine available when they used it. It was a Consolidated engine but much smaller than the Consolidated engines we have been discussing. In backing into LaPorte something happened. I don't know what happened to the valve mechanism. I never found out. But she started to thresh this reverse lever backwards and forwards. I heard the commotion, and noticed the engineer standing alongside of the boiler, but I could not see what he was doing. But I jumped from my side over there to see what was going on. He was trying to get hold of this lever. I said, "Earl, get away, leave that lever alone. She will kill you." He did not get hold of her although he tried several times to get hold of her after I had gotten over there, but he did not manage to get hold of her. When we got stopped, of course, he had the eccentric rod broke at the valve gear (T. 953–955).

The company made a settlement with me by reason of the injuries which I had described and gave me $17,000.00. They stood all the medical and hospital expenses, except the hospital bill at Peru and the Miami County Hospital, which was a small bill (T. 955–959).

236 CROSS-EXAMINATION

I am now farming and have been farming since the fall of 1929. I have an eighty acre farm and farm it myself. I was injured in April 1928, but have not fully recovered from the effects of the injury. I am not able to use my arms all right. I use them in farming and perform all duties except in threshing. My leg was broken but that is all right now. I have no trouble from my dislocated shoulder except getting such as "rheumatic pains." My health is all right with the exception of some limitation in the use of my arms. I made the settlement with the company in February 1929 (T. 959–961).

I spoke of getting two pints of valve oil from the roundhouse foreman on the trip on which I was injured on engine no. 383. At

the time I got the valve oil and before I started out of the terminal I inspected the engine and the valve gear; as to the quadrant I don't know that I could say that I inspected it because I look at it practically every time I move. I do not recall as to whether I noticed a stop block in front of the quadrant or not. There has never been anything said to us with regard to the stop block. We had noticed that the lever came too far forward for safety in the quadrant on engine 383, or a similar class, but as to the valve travel we had never noticed anything. In noting that condition I have not reported it on any of those engines. When I said the lever came too far forward for safety it was at the bottom of the lever where the clearance was too little. That danger could have been eliminated by putting a proper stop block there, which I understand has been done since. On the occasion, on hot afternoons, when as a fireman I would go over and help the engineer, that was not exactly in case I had an old engineer, I have also helped the young ones.

This was mostly in switching service and on hand-fired en-
237 gines. I figured my job of firing, in switching service, is not as hard as the engineer's job on those engines, especially on the afternoon's we were travelling south. I am forty-three years old (T. 961–964).

On engine 5501, where the ecentric rod broke, we don't know whether that was broke before the lever flew out or whether it broke while the lever was going back and forth on the quadrant. There is no way of telling. Neither the engineer or I saw it break. The running board covers all of the gear mechanism and you cannot see it unless you are on the ground or lean out of the window and see it, but it was broken when we got the engine stopped (T. 964–964).

REDIRECT EXAMINATION

I said I was not entirely recovered from my injuries. I have a disability with my left arm. I cannot lift that hand up. That is absolutely helpless—that is, my left hand. I can close it if I hold it back like that [illustrating] with my other hand, or have hold of something, but if I can hold my wrist back I can close that hand, but otherwise I could break that wrist by closing my hand. I cannot turn my right arm up unless I turn my full arm in the shoulder. That must be turned in the socket to turn my hand there [indicating]. I cannot turn my wrist. I can extend my arms out sidewise [illustrating].

"By Mr. MOREHOUSE:

"Q. Mr. Lowe, can you extend your arms out sidewise?

"A. Yes, sir [illustrating].

"Mr. MOREHOUSE. And may the record show that the witnes demonstrated by holding both arms out to the height of his shoulder, extended laterally?

"By Mr. MOREHOUSE:

"Q. When you speak of not being able to raise your left hand, Mr. Lowe, you raise it up approximately to the height of your
238 shoulder, of your left shoulder, did you not?

"A. Well, not from the wrist. I cannot straighten that hand out now. That hangs there. I have no use of the hand except to get down. It will drop down.

"Examiner ROGERS. What Mr. Morehouse is getting at is that when you raise your arm up the hand goes with it.

"The WITNESS. Yes, sir; my hand goes with it.

"By Mr. MOREHOUSE:

"Q. You raised your arm and hand up to the height of your shoulder?

"A. Yes, sir.

"Q. But the point you make is that the movment on your wrist is limited. Is that it?

"A. Yes, sir (T. 964–966)."

C. B. KINNAIRD, a locomotive engineer, employed by the Louisville and Nashville Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Lexington, Ky. I hired out as a fireman on the L. & N. in 1890 and was promoted to run in 1896. The territory in which I have had experience as engineer is from Lexington, Ky., to McRoberts, Ky. I have had experience in freight and passenger service, and at the present time have a passenger run from Lexington to McRoberts. We use a K–1 class of engines in that service, a 4–6–2 type, weighing 140,000 pounds on drivers, manually reversed. That is all we use on that division. I have had experience with a 4–4–0 type of engine, weighing about 80,000 pounds or less on drivers, with manual gear. These two classes of engines have a Stephenson gear and slide valves (T. 966–969).

On the 4–6–2 locomotives I am running, there is about a half-inch clearance between the reverse lever and the boiler, and the lever rubs the side of your clothes on your leg and wears out your over-
239 alls. It is that close between the lever and the seat. If the lever on those engines were to go from forward to back motion, back and forth over the length of the quadrant, and I was sitting on the seat box in my usual position, the lever would strike me (T. 969–970).

On a local passenger run from Lexington to Flemming, a distance of 206 miles, it requires ten hours to make that run. We have thirteen regular stops and fifty-two flag stops. The fifty-two flag stops are not all of them. Of course, there are some of them where we do not stop. They are flag stations, you understand, but ordi-

narily we have these 52 flag stops that we stop at nearly every day. As to what my general practice is as to the number of times I handled the lever on that run from one stop to the next, I will answer it is as many as five times. I estimate I would handle the lever about 300 times over the entire division (T. 970–971).

As to how much strength it takes to reverse the engine on this passenger run, I would say all you got. I brace myself with my foot against the brake valve, and pulling back the lever it will pull back like that [illustrating]. It is pulling back against there. It is hard to pull it back in reversing it or in cutting it back. I am indicating that it jerks me. It is a violent jerk. I have had the lever get away from me on these passenger runs while I was handling it. It would just be so hard that it would pull away from me and go down in the corner. I could not hold it. I have had the lever jump out of the quadrant when I did not have hold of it. It might have been that there were badly worn pins, the counter-balance not being properly adjusted, or dry valves, and it would happen in that way. At high speed, I have, at times, held my hands on the reverse lever latch to hold it and keep it from flying out of the quadrant (T. 971–973).

I have difficulty in keeping a lookout on these passenger trains while I am hooking up the engine. I have to give my attention to cutting the engine back and, of course, that takes my attention away from the way I am running (T. 973–973).

On the 4–4–0 engine I mentioned, with Stephenson motion and slide valves, the handling of the lever is just about the same as on the 4–6–2 type of engine. There is not much difference in them at all. I have had the lever jump out of the quadrant on the 4–4–0 type, or pull away from me while I was handling it (T. 973–973).

I was injured in reversing an engine with a manual bar on January 4, 1934, at Winchester, Ky., on engine no. 150, one of the 4–6–2 types, weighing 140,000 pounds on drivers. When we came into Winchester we have to get a clearance or moving order at this station. We went back to the office to get our orders, and in coming back I got up on the engine and the conductor threw his hand up and said "Let's go." I reached up and pulled the throttle open, and the engine would not move. I braced myself with my foot against the brake valve, and I pulled by degrees, like that [illustrating]. I finally got it back into the back motion after I had taken the slack. I then braced myself against the back end of the cab and shoved it to the forward motion in the same way. I was standing up behind the lever, shoving it into forward motion. When I did that I felt something like an awful pain, and I pulled the seat up and sat down and supported myself in that way. I thought I had just sprained myself. I felt the pain below my abdomen on the left side in the region of my groin. From there on my fireman assisted me every time I stopped. My groin gave me great pain all of the way. I finished the trip with his assistance in helping me. I was on the seat box the rest of the way.

"By Mr. McLaughlin:

"Q. Did you have to hold yourself in any way?

241 "A. Yes, sir. I would support the whole part of my abdomen like this [illustrating].

"Q. With you hands?

"A. Yes, sir (T. 973–975)."

I did not have medical attention that day, but the next morning, after I got back to Lexington, I had the doctor call. He ordered me taken to the hospital, and they moved me from my room to the hospital in an ambulance. The doctor said that the muscles and the ligaments were all pulled loose from my pelvic bone. I was in the hospital from the 7th of January until the 18th of February and was off duty on account of the injury until the 18th or 20th of February. The company paid me half time for the injury, amounting to $180 to $190.00. I feel the effects from the injury today. As to whether I know what caused the lever handling that way, I will answer "it was just working hard." After I got to my next stop I got down and walked all around and looked at the engine, the link motion and everything, but I could not see anything wrong. I have had very little experience with power reverse gear (T. 975–977).

CROSS-EXAMINATION

I am 64 years old and weigh about 245 lbs. Not all of the men on my division are that large. When I stated that the clearance was such that the reverse lever rubbed the engineer's overalls, I had reference to my own individual situation, right along my left leg. I never measured the distance between the side of the cab and the quadrant on that engine. I judge the seat box is 20 or 22 or maybe 24 inches wide. I have no estimate as to how much distance there is between the inside edge of the seat box and the quadrant. I cannot sit on the seat box and have my knees between me and the quadrant, facing the quadrant. I can get my foot down between the quadrant and the seat box. There is a shield down there. I can't very

242 well turn my foot around in there. This is not a seat box. They are all drop seats. It is probably four to six inches from the seat box to the quadrant. There is more room on the smaller engines (T. 977–980).

My statement that I would average hooking up the engine five times between stops was based upon the fact that you would move the lever down when you shut off to go into a station. Then when you were getting a signal to leave, you would gradually pull the lever back, and also do this in between stations. Between stations we come to hills, and we may have to drop the engine a few notches and farther up the hill the grade may be steeper and you may have to give it another notch or two or three. I counted each movement of the lever even if it is one notch, and those were the sort of movements I had reference to when I said I would make 300 movements in a day's run. That would be over a period of ten hours duty, or ten

hours running time. It is my impression that I would average one movement of the lever every two minutes. On the average, it will take all the power you have to make one of these movements of the manual lever. There are times when we are not working the engine hard. I have not often found that sometimes it is a great deal easier to handle the lever than at other times (T. 980–983).

I have never been injured by the lever jumping out of the quadrant and going into the corner. On the occasion when I was injured the lever did not kick or jerk me. I was pushing against the resistance of the lever and overstrained myself after I had pushed it back. I may have started it when I was pulling the lever back to take the slack, and then when I had it in back motion I could not shove it ahead until I braced myself. It was just by degrees that I could shove the lever ahead. I think the strain came in reversing the engine both on the reverse movement and on the forward push. It was
243 not unusually difficult on that occasion; it is all of the time on these engines, they all handle hard. In a case of this kind the engine handles awfully hard, and I will say unusually hard. As a matter of fact, the valve was out of adjustment or there was a defect in the valve. I only know what I have found out after my injury, and I found out that the valve in the valve seat was cut so that the yoke fit it too tightly. The people where I had my room called the family physician, and he took me to the hospital in the ambulance the next morning. Later on the company doctor was called in and made the statement about the muscles being torn loose from the pelvic bone. He told me at first he thought I was ruptured, but afterwards he determined I simply had a severe strain of the abdominal muscle. I have been serving as an engineer since 1896 and this is the only occasion where I have overstrained myself in this manner. It is the only personal or physical injury I have had in handling a reverse gear (T. 983–987).

Mr. Miller announced that it was necessary for him to leave the hearing for a while. He asked counsel for complainant to stipulate that if a motion be offered at the conclusion of the complainants' case, on behalf of the carriers, to dismiss the complaint because of jurisdictional grounds, that said motion may be considered as being made on behalf of the Short Lines which he represented. The stipulation was agreed to by counsel for the complainants (T. 987–987).

JAKE PASCHALL, a locomotive fireman employed on the Louisville and Nashville Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Paris, Tenn. I hired out as a fireman in 1918 and was promoted to engineer in 1923 and have run as an engineer.
244 My division is between Paris, Tenn., and Bowling Green, Ky. I have had experience in freight and yard service as an engineer. I also have fired passenger engines about five or six years

and have helped the engineers reverse the engine. In freight service we have the H–25 A and B classes, a 2–8–0 type, weighing 170,000 to 200,000 pounds on drivers, equipped with manual reverse. In passenger service we have a Pacific type weighing about 140,000 pounds on drivers, manually reversed; and the so-called small 4–4–0, weighing less than 80,000 pounds on drivers, manually reversed. In yard service we have the H–23's, a 2–8–0 type, weighing between 140,000 and 170,000 pounds on drivers, manually reversed. I have had experience in handling the manual lever on all of these classes. The small passenger engine and a few of the yard engines have Stephenson motion and slide valves. Nearly all the yard engines have slide valves (T. 987–990).

The yard engines are a deckless engine, and the reverse lever is about two inches from the side of the boiler. They have good clearance both front and back, and they have a drop seat for the engineer, and the seat extends almost out to the reverse lever. I would say the approximate distance between the inside edge of the seat and the lever is about two inches. It is very uncomfortable to try to sit down and operate those engines, and we generally stand up. There are times when we would be sitting down with the engine moving and if, while sitting on the seat box, the lever should come out of the quadrant and travel over the distance of the quadrant either way, it would be likely to strike you. The quadrant on the freight engine is built up about even with the engineer's seat box. On these engines the reverse lever won't clear the man sitting on the seat box. It won't get past by you. You have to get up to operate it. On the passenger engines of the Pacific type, the reverse lever
245 is behind the boiler head, and the quadrant is built about flush with the floor of the cab. The lever clears the boiler head about two or three inches in front and in full back motion it extends out about four inches back of the backboard of the cab. The clearance between the lever and the backboard is very close; I do not suppose over three or four inches. Our engineers do not attempt to put the engine into back motion from the seat box. They either get the fireman to do it or get down into the deck (T. 990–992).

I have had experience as an engineer on a through-freight run from Paris to Bowling Green, Ky., a distance of 134 miles, requiring eight or nine hours run. The territory is pretty hilly. With an ordinary trip and no extra amount of work to do, the engineer would make about 200 adjustments of the reverse lever on that trip. The grades, stops, and meeting points, together with the fact that we take coal, water, etc., accounts for that number of movements of the lever. I have had experience on a local run, covering 80 miles of that territory, and I find that I have occasion to move the lever a lot more times than in through-freight service over the same amount of territory. This is because the locals do switching and construction work and spot cars, etc., at different points up and down the division, that the through-freight trains do not do. Most of the points where we

switch thirty minutes, we would reverse the engine twenty or twenty-five times (T. 992–994).

As to the amount of strength required to reverse one of these freight engines, on the average a man can brace his foot and take both hands and throw it over all right. We have some that handle harder, and it takes more strength. I always brace my foot on
246 the foot brace or brake valve. The reverse lever jerks when you try to pull them back as you are hooking them up. Usually in reversing we are standing still, and it is a pretty hard pull all the way back. Most of our freight engines have a foot brace which is attached into the quadrant and we brace our foot against that. If they do not, we brace it on the brake valve or some other place in the cab (T. 994–995).

I have had the lever get away from me while hooking up an engine. They jump down in the corner. They will jerk out of your hand when you unlatch them. This would have an effect on you if you do not let loose of it, but I have never been injured by it. I have been jerked by it. Dry valves, broken or improperly adjusted counterbalance springs will cause the lever to act in that way. I had a counter-balance spring break in my experience as an engineer. I did not know it was broken until I went to hook up the engine, and it just jerked the lever out of my hand and it went to the front corner. As soon as I unlatched the lever it went right down. Other causes of the lever jerking or jumping out of the quadrant are worn teeth in the quadrant and a number of other things. Sometimes the lever gets away from us and we apparently can not find any reason for it. When the lever goes to the corner it generally stays there. Sometimes it will beat; that is, stop or raise up just a little way. It will beat every time the valve travels over the seat on both sides. About three weeks ago, with a heavy train we were approaching the foot of a grade, running about 20 miles an hour in freight service, with a 2–8–0 engine. Suddenly the engine sounded to me like she was tearing herself up, and I heard the reverse lever back against the front end of the quadrant, and I went around, and the engineer was standing up trying to pull reverse lever up. I helped him, and we could not get it up, so that we
247 had to stop the train before we could pull this reverse lever up (T. 995–997).

I was injured, while serving as a fireman, in assisting an engineer handle a manual lever. The date of the accident was April 10, 1928; the place, Erin, Tenn. We had a Pacific-type engine, weighing about 140,000 pounds on drivers, being engine no. 203. I was firing on a passenger train and we stopped at Erin, and when the engineer opened the throttle, the engine would not start the train. It was necessary to take the slack. He was not physically able to reverse the engine; I braced my foot against the boiler-head and put the engine in back motion, and it was necessary for me to get behind the lever and brace my foot against the tank to put it in forward motion. I

was taking up the slack. When I worked on the lever my foot slipped, and I ruptured myself. There was no foot brace provided for me. That was the way I had been performing this operation. I do not think there is any place you could put a foot brace that would not be in the way in the deck. The doctor found I had a hernia and I was off duty on account of the accident for fourteen days. I still have the hernia (T. 997–999).

I am thirty-three years old. I started firing in 1918 and was promoted in 1923, and have run probably a year and a half as an engineer. I have had no experience with power reverse (T. 999–1000).

CROSS-EXAMINATION

I always assist the engineer in reversing the engine on passenger engines, except in case I do not happen to be in the cab. The one particular engineer to whom I had reference is not physically
248 able to reverse the engine, but I help all of them when they reverse the engine. It is generally necessary for me to help him as it saves delay to our passenger train and is quicker. That is because when you reverse the passenger engine in taking slack one man can hardly reverse them with steam in the valve chamber, and also because you had got to get down into the deck to reverse the engine. When I said that on some of the engines, when they are in good condition, the reverse lever can be thrown over without great difficulty, I had reference to freight engines. The passenger engines are more difficult because you cannot get to the lever on account of the backboard of the cab. The lever is hard to handle, too. The passenger engines have piston valves. I have never seen or experienced any one being injured by becoming in contact with the backboard. I have never been injured with the lever going to the corner, because I let it go. I do not think I have ever observed, on any of these engines, the occurrence of the reverse lever threshing back and forth from forward to reverse positions. I have never been injured enough to be reported by being jerked with the manual lever. On the occasion when I was injured I said that I braced my foot on the tank and my foot slipped. My foot was just on the side of the front wing of the tank. It was not wet, nor was there any condition which caused my foot to slip. I had nothing stable to rest my foot against. I made several attempts to move the lever and the injury occurred just as my foot slipped. I had my foot braced behind me and I was shoving on the lever and it just kind of stretched me out when my foot slipped off of it. I felt the pain then. I made a statement to the master mechanic and told him that I had examined the engine afterwards and did not find any defect which would have caused it. I would not say I had put myself in a strain-
249 ing position. I had just braced myself. It was a strain to throw the lever ahead. I do not remember telling him that I must have put myself in a straining position (T. 1000–1004).

In speaking of a through freight run where I have estimated I would make 200 adjustments of the lever, the number of times that I would completely reverse the engine, depends on the amount of switching and setting off and picking up cars we have to do, and I could hardly answer that. I believe you would completely reverse your engine about 25 or 30 times. You would not be required to do that except where you have switching or spotting the engine at water tanks, coal chutes, etc. Most of the engines about which I testified have a foot brace at the forward end attached to the quadrant, but there is no similar brace in the rear. I do not think there is any practical place where a brace could be placed at the rear. In passing in and out of the cab we have to pass the rear end of the quadrant, and I think it would be dangerous because of stumbling over it. There was no injury to anyone in connection with the instance when a counterbalance broke. The engineer on the engine, at the time I was hurt, was not a very strong man physically. He had had his back hurt and wears a brace. As to whether I customarily assisted him more than I would other engineers, I will say that it was harder on me because I had to do it all in connection with reversing. The engineer always asked me to do it, and he could not assist very much (T. 1004–1006).

I have fired all of our passenger runs regularly at different times. Most of our passenger runs are heavy trains and we very often have to take slack in starting them. We do not do this at every station. On our local passenger runs perhaps we do not reverse the engine completely over half a dozen times. We rarely have to re-
250 verse them on a light train. On our heavy through trains, from Paris to Bowling Green, a distance of 134 miles, I would say we have to reverse the engine four or five times on an ordinary trip. The brake valve is located right in front of the engineer's seat, or just a little in front of the front end of the quadrant and a little to the right of the quadrant. The brake valve is up above the quadrant. It might be four or five inches to the nearest pipe of the brake valve. The part of the brake valve where I braced my foot is really the air chamber, and is about six or eight inches in diameter, and is cylindrical in shape with the length from the cylinder extending vertically up and down. The nearest part of it would be four or five inches to the right of the quadrant. Probably the top edge of the brake valve comes over even with the quadrant. The chamber itself is over to the right, so that it is directly in front of the seat box and makes it a convenient place upon which he can place his foot (T. 1006–1010).

H. C. GANS, a locomotive engineer employed by the Louisville and Nashville Railroad was sworn and testified as follows:

DIRECT EXAMINATION

I am fifty-two years old and live at Louisville, Ky. I was employed as a fireman on the L. & N. in 1903 and was promoted to

engineer in 1910. The territory which I run is from Louisville, Ky., to Evansville, Ind. My experience has been almost entirely in through freight and local. At the present time we have two types of manually reversed locomotives in freight service; the H–27 and H–29's, a 2–8–0 type, ranging between 170,000 and 200,000 pounds on drivers. The H–27 is a deckless engine and clearance at both ends of the lever is about three inches, but where the lever passes
251 the bulge of the boiler it is jammed up against the boiler.

When I am on the seat box there is less than one-half inch clearance between the lever and me. They are all drop seats on those engines, and the drop seat sets back up against the reverse lever. You can sit on the seat when running in forward motion, but in backward motion you kick the seat out from under you in a second. The H–29 engines are a larger type with a half deck. The reverse lever quadrant is at the rear of the boiler. There is about one-half inch clearance between the lever and the boiler or the pipe when it is in full stroke ahead. In rear stroke there is about three inches between the tip of the lever and the back of the cab. The lever is inside the cab, about three inches inside the backboard. I have had my elbow come in contact with the backboard several times, but it did not hurt it (T. 1010–1013).

My usual run is from Louisville, Ky., to Evansville, Ind. On a northbound movement with a through freight train I estimate that I will have occasion to handle the lever between 150 to 200 times. Southbound you do not double the hill and you might cut that down 25 times (T. 1013–1013).

As to how much effort it requires in reversing the lever on those engines from one corner to the other, it all depends on the engine you have. Sometimes you cannot do it by yourself. I recently had an experience, week before last, with engine no. 1312, an H–29, in service which was local freight, one-half of the way and through freight over the other half of the road. I do not believe, in the four days I had this engine that I reversed it by myself 20 times, but I had to have the assistance of the fireman. Apparently there was nothing wrong with the engine at all. It had not been out of shop long and was just stiff and hard to handle. I did not notice any difference from the time I got that engine until I came here. I ran the engine about 604 miles in these four days. No one else
252 ran the engine during that time (T. 1013–1014).

I am pretty long-legged and in hooking up the engine I generally throw my right foot up against the brake valve and grab the reverse lever in both hands and come back with it the best I can. I throw my weight against it and it comes back. There is always a jerk to it. The jerk is caused by the pull against the valve, dry valves, tight rings; maybe the valve gear is not properly lubricated, the reach rod could be binding, or the quadrant might be tightly adjusted, a binding in the quadrant. I have had those things happen, but I could not tell you a specific case of it right now. Of course, the

counterbalance of springs could get out of adjustment at any time. In reversing an engine you have not got the pull against the valves, the pressure against the valves standing still, which you have when running. I have occasions to reverse the engine with steam in the cylinders, although that is only in taking slack. That makes a great deal of difference in handling the lever. It takes all your strength and then some to get it over at times, especially on the H–29 class. Opening the cylinder cocks under those conditions will relieve the situation a whole lot when you do it, but you might be around places where you cannot do it. It takes about one minute to drain your cylinders and steam chest, I should judge, although I have never timed it. In practice you do not take that amount of time to open the cylinder cock. You can throw it the other way. If you cannot throw it you will open the cylinder cock (T. 1014–1017).

I was injured in reversing an engine equipped with the manual lever on November 26th, 1926, at Lodiburg, Ky. I was then in through-freight service with Engine No. 44, an H–27, weighing about 172,000 pounds on drivers. We were going down hill and I went in to head in for a passenger train. I had fouled the switch points and had taken slack and backed up to head in. I braced myself securely on the floor of the cab to throw the engine ahead,
253 and in so doing I tore all the ligaments and cartilage along my right knee. I had thrown the lever to full backward position and I was throwing the engine ahead, braced on the floor. The cylinders were all full of steam. I was pushing on the lever to throw it ahead. The brakeman had already opened the switch. The ligaments were all torn loose in my knee and I made a dive for the left window and caught myself with my arm as I was going out of the window. I did not handle the lever any more. We went to Evansville and the fireman adjusted the lever whenever necessary on the way. I laid off at Evansville and was off duty four months and in the hospital twenty-four days. The company paid me in the neighborhood of $500.00, and they also paid the hospital and medical expense. Prior to this accident, in June, I had bumped my knee climbing on an engine and a knot formed under the knee. I had that lanced and a lump, about the size of an egg, raised up under my knee. I do not know whether there is any connection between these two injuries. There were no ligaments torn in connection with the lump on my knee (T. 1017–1019).

I have had about ten years' experience with power reverse. During that ten years it is difficult to say what proportion of the time I was handling power-reversed engines because the engines were in pool service, but I think one-fourth or one-fifth of the time was spent with power reverse—the Alco gear. I have never had any difficulty in reversing or hooking up the engine with power reverse and have not been injured in handling power-reverse levers (T. 1019–1020).

CROSS-EXAMINATION

I have reversed a manual engine thousands of times without the assistance of a fireman. On the H–29, since I have got hurt, nearly all the boys help me when I get a hard one to handle. If I
254 cannot work it they will step in and help me throw it. They all know I have a bad knee. Before my knee was hurt and since that time I handled the lever many times a month myself.

By Mr. ALDERMAN:

"Q. Did I understand you to say that it was not necessary to undertake to reverse the engine when you had steam trapped in your cylinders, except in connection with taking slack?

"A. Well, no; it is not necessary to release it except when you leave your engine over the pit, of course, we always leave our cylinder cocks open then.

" Examiner ROGERS. Do you not ordinarily leave them open when you are standing around, so that the pressure won't build up in the cylinders and move the engine?

" The WITNESS. Not when there is anybody with it.

" Examiner ROGERS. I mean when there is not anybody with it."

By Mr. ALDERMAN:

"Q. But, as I understand, if you undertake to move your reverse lever and it moves easy, you do not bother, but if it moves hard, then you drain your cylinders?

"A. If you are in a place where you can (without) scalding someone; yes, sir."

A man can be standing eight or ten feet away from an engine and be scalded by the cylinder cocks being opened and blowing steam. The cocks on our cylinders blow through underneath the engine, that is, blow inwards. They formerly blowed outward. There is a good deal less danger now of anyone being scalded (T. 1020–1022).

In connection with my injury I mentioned that I had hurt the same knee by bumping it against something, in June before the November when my accident occurred. That had nothing to do with the reverse lever. The knot, as the result of that bump, developed right
255 underneath my knee. It gave me no trouble at all but a lump the size of an egg formed there and I went to the doctor and he lanced it, but it did not bother me at all. After he lanced it it ran pus. The knee had quit running pus, but when I hurt my knee the second time and tore the ligaments loose, then it ran pus for three weeks. The injury got around and involved the knee cap when I tore the ligaments loose. The pus had quit running for a week before I tore the knee loose. They informed my wife and the company that I had one chance in a thousand of saving the leg. They thought I had developed blood-poisoning. That was after I tore the knee loose. The pus condition had stopped entirely and when I got this strain in November it started up again. I presume this previous

condition had weakened my knee to some extent, but I could not positively state as to that (T. 1022–1024).

On the 1200 class, H–27 engine, I said something about the lever being jammed up against the boiler at the point where the boiler bulges. I had reference to the part of the lever right down above the quadrant. There is ample clearance for my hand. I do not have to put my hand or foot about the lever at that point where it comes close to the boiler (T. 1024–1025).

With reference to engine no. 1312, which has just come out of the shops, it was snug and tight all over. I had two trips on the road with it. It had not loosened up, so that it handled easier when I left. It had been in service about a month over our division. I do not know whether they had been running it on any other division or not. I went over the reversing gear all over it, everywhere; that is, the valve gear, and reported it at each end of the road as handling hard. I did not discover any other reason than that it was tight. The engines I operate have piston valves. That is a type of valve where the steam pressure is equal against both faces of the valve. That is true regardless of the position of the valve. There is a piston valve inside the valve and the pressure is confined inside that
256 at all times. I am talking about the inside admission type of valve and the faces I refer to were the inner portion of the valves. The pressure is supposed to be the same at all times inside the valve either with the port covered or not. In other words, with that type of valve there is a chamber or space that is cut out of the valve. When I refer to the "faces" I mean the faces of the valve on this inside admission chamber where the steam pressure is. Of course, when you uncover either port the steam is going in there. So far as the inner pressure in that chamber is concerned, the pressure is supposed to remain the same at all times, because it is taking that pressure from the steam pipe leading to the boiler. That type of valve is called a balanced valve. The steam pressure in my judgment is bound to be somewhat lower when one of the ports is opened than when the port is closed (T. 1025–1030).

257 J. M. Dixon, a locomotive engineer, employed by the Louisville and Nashville Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Louisville, Ky. I hired out as a fireman on the L. & N. in 1902 and was promoted to engineer in 1911. My division is between Louisville and Nashville. I have had a little experience in passenger and freight service, but mostly my experience has been in yard service. At the present time we have yard engines of a 2–8–0 type, ranging in weight from 100,000 to 200,000 pounds on drivers. Some of them are equipped with Stephenson motion and slide valves. As to clearance on these engines, they are pretty snuggly fixed up. We have fairly good clearance. On the particular

type of engine I am handling now I estimate they have about three inches from the drop seat to the lever. On the 600 class of switch engines, weighing 100,000 pounds on drivers, when the lever is in forward motion, in order to reach across to the injector you have to reach over the front part of the quadrant (T. 1030–1033).

At the present time I am working in the Louisville terminal classifying freight cars. We take our engine and couple on to a cut of cars, which varies anywhere from ten to twenty-five or thirty; pull them down on to what we call the lead track and then switch them out to the various tracks. In that process we have to throw the lever backward and forward quite a number of times, most every time you kick a car. Every time you kick a car that usually requires a movement of the reverse bar from one corner to the other. You have to make these movements just about as fast as you can. It is hard to say how often I handle the lever in kicking cars, but I estimate that in an hour's time you handle the lever from 30 to
258 40 times. I believe that average will hold good over an eight-hour trick (T. 1033–1034).

Under ordinary conditions the lever handles fairly well, but it requires most of your strength to handle it. The conditions which cause them to handle hard are: trapped steam in your cylinder and steam chest. I have had a good deal of experience with that. Other conditions are the adjustment of the counter-balance spring, dry valves, poor lubrication, tight connections (T. 1034–1034).

I was injured in handling a manual lever in yard service on June 10, 1928, at Louisville yards while operating engine no. 999, one of a class weighing between 140,000 and 160,000 pounds on drivers. I was handling some coaches, backing them down into the track to couple them on to a cut of coaches that was on this same track, and they made an effort to couple and the cars did not couple. They gave me a signal to back up and they failed to make the coupling about two or three different times. Finally, they made the coupling and gave me a signal to slack ahead, as they have no indicator on these couplings to show when the cars are coupled. I tried to get my reverse lever over after I had made the coupling, shoved back and made the coupling, and I got the reverse lever up about two notches in the quadrant, and she stuck, and I lunged at it and could not get it over and I got behind it and shoved it until it got to the center. It goes pretty easy when you get the exhaust steam, the escaped steam out of the way, and it went on down. I felt a severe pain, such a pain that I put my hand down to see if there was anything wrong and I found I had ruptured myself in the groin, a knot there about the size of your fist, but I continued my operation as I had very few moves to make finishing out the day's work; and we had a very
259 important train and we were all very particular about getting out on time. I had a new fireman and could not trust him with the engine under such conditions, not knowing what he could do. When I finished my work I went home. The company doctor

said it was necessary for me to undergo an operation. I went to the hospital and they operated on me right away. I was in the hospital about fifty days and off duty about that length of time. The operation was for a hernia. The company compensated me for about half-time, amounting to $180.00 (T. 1034–1037).

I have had experience with power reverse in the yard and did not have a bit of difficulty in reversing engines equipped with it. I have used the Alco and Maxwell power reverses. With the Alco I estimate that it will take, roughly, about three to four seconds to reverse the engine. It is hard for me to estimate the length of time it takes to reverse a manually equipped engine, but it takes more time than with the power reverse. I should think you would figure up to something like thirty to forty seconds on up to five minutes to handle a manually reversed engine if they were tightly and snugly fixed up; that is, from the time you put your mind on it to reverse (T. 1037–1038).

CROSS-EXAMINATION

I fired pretty continuously from 1902 to 1911, and since 1911 have served as engineer pretty continuously. During the period when I was firing I had experience in handling manually reversed levers and would help the engineer at various times in handling his engine. As to how much of the time since 1911 I have handled manual as compared with power-reverse engines, I will say that perhaps a month or so you will handle the power-reverse and then you
260 will get a manual-reverse engine. It varies so it is hard to make a close estimate. The company first got power-reversed engines five or six years ago. For the first fifteen years after I had been promoted all my experience has been with manual reverse, and in the last five years I would say about one-fourth of the time has been with power reverse and three-fourths with manual engines. I am using a manually reversed engine now. I said that under ordinary conditions the manually reversed engine handled fairly well, and then gave some extraordinary conditions that might make them handle differently. One of those conditions was trapped steam in the steam chest. On the occasion when I was injured I had the steam trapped and did not take time to open the cylinder cock and drain the steam. I was in the yard, right at the head of the passenger shed, not very far from the depot. My engine was right about the end of this passenger shed. There are always people down there working. I cannot recall whether there was anybody standing around the forward end of this engine at that particular time or not, as I was giving all of my attention to the signals given behind me. The reason I did not drain the trapped steam was not that I did not want to take time but was because of "safety first." I never handle my engine around the passenger yard with the cylinder cocks open. The lever on this occasion did not kick or injure me by its movement. It was my strain in trying to throw it over. I had

brought it part way up the quadrant as far as I could get it and could not get it any farther. Then I got behind it and pushed it all the way over. I had no way to brace myself and had to stand on the floor and get support as best as I could, but I actually got it over myself. I could not say in what position I was standing when I felt the strain. This is a deckless engine, and I lunged at it
261 until I got it up a portion of the way until I could get behind it, and I got behind it and kept working on it until I got it over. There is no brace on that deckless engine on which I can brace myself in order to push. I could not say as to whether there is a brace on the bottom part of the reverse movement. I had no previous weakness in the region of this hernia. As to whether this is the only injury which I have ever had operating a hand lever, I will say that I have had several minor injuries which did not amount to very much, knocking my elbows, catching my arms, first one thing and then another minor matter; nothing serious. I could not say I have had anything to cause me to lose time. I have not been injured to any extent, I do not think, by the hand lever coming out of the quadrant and going into the corner. I have never seen an engine reverse herself alone that I know of; that is, the lever flying backward and forward from forward to backward position. I have never timed myself by a watch as to the time it takes to reverse an engine with power reverse. I have just given it as a rough estimate (T. 1038–1045).

In kicking cars in classification service, I do not think I have to reverse my engine movement for every car. I said that most of the time we had to reverse the engine on account of kicking the cars a little up-grade. We always kick them up-grade in the Texas yard at Louisville where I work. When we have a string of cars we are kicking one car off the end, one at a time or maybe more than one at a time. Maybe two or three in a cut. Once in a while you can just kick one car or a cut of cars off and then stop your engine, and being in forward motion move forward without reversing the engine. You are lucky if you can kick them up-grade and stop before getting over the switch. Ninety percent of the time you get over the
262 switch and have to slack ahead at that particular place. We spend the majority of a day's work in that way, over an 8-hour shift. We have very little time, when the engine is not working. We have about 20 minutes for lunch. We do not have to wait for more than a few seconds for a train to be broken up. Sometimes they do not get through. I have had to wait for a few minutes, maybe three or four minutes for bleeding off the air. I have got a good crew and am not detained two or three minutes until the switch crew takes away the car, after it is kicked off the train (T. 1045–1047).

I have never timed myself by a watch to see how long it takes to completely reverse the manual lever from one position to another. It will not take 30 or 40 seconds to reverse the engine with a hand

lever if everything is in good working order, but I would not say I can do it just as quickly with a hand lever in good working order as with a power lever in good working order. I think it takes a little longer with the hand lever. I would say double the time at least. I have never made a test to compare one with the other with my watch, or never lined up two engines and compared the gears at the same time (T. 1047–1048).

Additional appearances were noted in the record as follows:

Mr. J. R. Skillman, Louisville, Ky., appearing for Louisville & Nashville Railroad Company.

Mr. William J. Kane, 921 Transportation Building, Washington, D.C., appearing for American Railway Association (T. 1048–1050).

263 T. B. Pool, a locomotive engineer employed by the Chicago, Rock Island and Pacific Railway, was sworn and testified as follows:

DIRECT EXAMINATION

I live in Chickasha, Oklahoma, and hired out on the Rock Island as a fireman in 1906 and was promoted to engineer in 1914. I run from Caldwell, Kansas, to Waurika, Oklahoma. I have had some experience in all classes of service, but not lately in passenger service, having done no passenger work for three or four years. At the present time I am employed mostly in local and switching service. On our local freight work I am now using a 1700 class of engine, a 2–8–0 type, weighing about 180,000 pounds on drivers, manually reversed. We also have the 1400 class, also known as the T–28 class, a 4–6–0 type, weighing 137,000 pounds on drivers, manually reversed. We have an 1800 class, a 2–8–0 type of engine, weighing about 120,000 pounds on drivers and a 250 class of the 0–6–0 type, weighing about 150,000 pounds on drivers. Both of these classes are equipped with the manual gear. The 1800 class has the Stephenson motion and slide valve (T. 1050–1052).

The cab arrangement of the 1800 class is very close. There is hardly room in the cab to operate the reverse lever at all. It is a deckless or half-deck engine—I do not know which. There is very little clearance between the lever and the boiler. The lever runs alongside the boiler, and there might be a couple of inches clearance. Some of these engines have drop seats. The lever runs pretty much ahead of the seat and comes back to the seat and in back motion you cannot get in the gangway but must drop the seat down in
264 order to get there. The quadrant is just above even with the outside corner of the seat. If you are sitting on the seat box and the lever is thrown or placed in backward motion there is very little, if any, clearance between you and the lever. The lever comes right up against you. I have often dragged the lever against myself in pulling it back (T. 1052–1053).

I have a local freight run between Chickasha, Oklahoma, and Hobart, Oklahoma, a distance of 72 miles, that I make in all the way from 8 to 12 or 14 hours. On that run, under ordinary conditions, I have about eight stops. At these stops there is switching at the stations, such as setting out, spotting, or picking up cars. The length of time consumed in such switching varies a great deal. At different times of the year, in cotton season, sometimes they switch two, three, and as much as four hours. At this time of the year the switching is very light, twenty minutes to an hour. I would say that when I am switching for an hour I will reverse the engine approximately thirty to forty times. In local freight service, when I am moving over the road I raise or lower the lever, according to the grades. When we come to a hill we let the lever down to where the engine holds the speed necessary to handle the train, and when we get to where the train is running better we put the lever back. There are places when you will drop the lever down and hook it up probably as much as ten to fifteen times in ten miles. At other places it would be less (T. 1053–1055).

As to the amount of strength which is required to reverse these engines, both freight and yard engines, some engines can be reversed tolerably easy and others take all the strength I have and sometimes more. I have had occasions where I have to ask the fireman to help. I have had new engines out of the shop which work hard and which I could not handle. They used to give us a
265 colored man on the engine for a day until we could get the engine where we could handle it. That has been several years ago. Our shops have been working but very little lately. Most of our engines are equipped with a foot brace, which I use in handling the lever. When I am hooking up an engine, braced with the help of my foot brace, I have had levers fly out of my hands when I would unlatch them, and go to the corner. I have had them give me some pretty hard jerks when I tried to hang on to them. You would unlatch the lever and it would jerk forward that way and would jerk my neck and pretty near make it pop. I have had that happen several times in my experience on locomotives. When I was firing I saw an engineer try to hook up an engine and he was thrown to the floor of the cab and his breath knocked out of him. That was on a 1300 class engine, no. 1312, weighing about 150,000 or 160,000 pounds. He was running, I suppose, between forty and fifty miles an hour.

"By Mr. McLaughlin:

"Q. Will you describe what you saw on that occasion? What was he doing?

"A. He just raised up and unlatched the lever, preparatory to hooking it up. We had just gone up a hill, around a curve, and down a steep hill, and it dragged him forward and I seen him fall—it was a full-deck engine and we sat side by side and I stepped down in the deck and threw the throttle over. I came around and got

the brake valve and slowed the train down to 20 miles an hour and raised him up and put him on the seat box and held him until he came to. We were then about to the yard limits beyond the station and went on down and got the station stop and then asked the engineer if he was hurt much and he said, 'No; I am all right.' And by the time we left there he was able to take the train.

266 "Q. How long was it between the time you saw him pitch forward and the time you made the station stop?

"A. Oh, I suppose four or five minutes.

"Q. Do you know how far the engine went before you stopped?

"A. I did not try to stop it before getting to the station. I just slowed it down a little.

"Q. How far was it before you got it slowed down sufficiently to get the lever out of the corner?

"A. I never took the lever out of the corner. I left it there, but I eased the throttle off. The train went to the station without any more steam (T. 1055–1058)."

When I am running along at high speed some of the levers are quiet and some of them jerk back and forth. If I get afraid of them, sometimes if I have a hand feed lubricator I check that also and give it more oil, and sometimes put a monkey wrench in the reverse lever to hold it. Under those circumstances I have had a lever jump out of the quadrant and go to the corner more than once. I think there are several causes for that. Mostly it is dry valves. That might be caused from improper lubrication, leaky dry pipes, engine foaming, working water, and worn cylinder packing would affect the lubrication. I have had leaky dry pipes and that affected the lubrication. The notches on the quadrant where the latch fits may be worn or a weak spring in the reverse gear would cause it. I am not always able to ascertain what is the cause of the lever jerking or jumping out of the quadrant. We have a great deal of trouble with the yard engines foaming, causing dry valves and making them hard to handle (T. 1058–1060).

I was injured in handling a manually operated lever with the train in motion on two occasions, once in local service

267 and the other time in switching service. The accident in local service occurred about June 29th, 1928, near Komalty, Okla., with engine no. 1402, weighing about 137,000 pounds on drivers. The situation with reference to clearance was that the reverse lever did not clear my leg when I was sitting on the seat. I was sitting right on the seat box with my hand on the throttle running about 15 to 18 miles an hour when the engine reversed itself and the reverse lever flew back. The seat was unusually long on that engine and throwed the reverse lever about as high as my head. When it came back it came back so quick I could not see it, and it grazed my head, cut my glasses off, skinned my face and ear, and cut my knee cap open in two places, and went into the socket. I was taken back to Hobart to the hospital, about seven miles from there. A company surgeon operated on my knee and put my whole leg inside of a

plaster of paris cast, and I laid there three weeks and then was taken to my home in Chickasha. It was six weeks before they took off the cast. It was three months before I went back to work. At the present time I have a stiff leg from that injury. The company paid me $2,200 and also the hospital expenses (T. 1060–1062).

I was also injured in switching service, five or six years ago, in handling a manual reverse bar. I was handling a small switch engine, none of which are used at the present time. It was about a 140,000-pound engine and was engine no. 109, equipped with Stephenson motion and slide valves. I was weighing cars over the track scales. I had weighed one car and got a signal to come ahead with the next one, and the lever was a few notches from the forward corner and would not start. I raised up and gave the lever a hard push to get it down in the corner and ruptured myself in the left groin. I did not have medical attention for that. I did not know at the time what I had done. I have effects from the
268 injury at the present time. It got worse and I am wearing a truss now (T. 1062–1063).

I am fifty-eight years old. There are some engines on my division equipped with power reverse gear but I have never operated one of them. I work on the branches out of Chickasha. It is not regularly freight terminal work and they use only our smaller engines there (T. 1063–1063½).

CROSS-EXAMINATION

I was promoted to engineer in 1914 and since that time I have had about fourteen years of running as an engineer. The accidents I have related are the only serious accidents I have had due to manually reversed levers in that time. I had another accident due to jumping off an engine, but it had nothing to do with the manual lever. I stated, in describing switching service, that during one hour of switching I would operate the reverse lever 30 to 40 times. As to how long it takes me to complete each individual switching operation, I will answer that if I come into town with a train and have to pick up one car, I would shove my reverse lever ahead to shut the engine off, open the switch and throw the lever in back motion to back up, go in and get the car and throw the lever into forward motion, then throw the lever into backward motion to go back, and then forward to go forward again, and that would be five or six times to get one car. It would probably take ten minutes. I make reports to the shop foreman of the instances where the lever goes to the far corner, caused by improper lubrication or leaky dry pipes, or a foaming condition, and these conditions are remedied. I did not experience the same trouble after these things were remedied. I had an engine a year or two ago with a leaky dry pipe and ran it a day or two before I found out what was the matter. I told the
269 roundhouse foreman and he tested the engine and found out that this condition existed, and put the engine out of service

and gave it a new dry pipe. It worked easier after that was done. The engineer can make frequent use of his blow-out cocks when the engine is foaming, but in the yard there are few places you can blow the engine out because we are instructed about being very careful not to use the blow-out cocks where they will blow on anyone. I have usually blown out the engine before I go to work and blow them out every time I get a chance, maybe four or five times in eight hours in switching service. When the engine comes out of the shop it is tight and stiff all over, and it is more than a man can handle until it gets worn down and loosened up. I have not had any engine out of the shop for several years. When I did get engines out of the shop, it sometimes took three or four days before we could handle them all right, some longer than that. By the time we get the engine from the other shop they are generally pretty well worked down. It would be a thousand or more miles from those shops, to where we work (T. 1063½–1067).

With reference to the accident when I was firing and the engineer was hurt, I do not think the accident was reported. If the engineer reported it, I do not know. This occurred just before the engineer was retired at the age of 70 years. The accident occurred in 1914 or 1915. With reference to the accident on engine no. 1402, I made an inspection of that engine prior to the date when the accident occurred, and as far as I can find it was in good shape. I consider it safe to operate as far as I have seen. The accident occurred on June 28th, 1928. I did not make an inspection after the accident, but I think an inspection was made. I read the report of the inspector. As to what caused the reverse lever to fly back, I only know from the report I read. After the accident I could not
269 walk. They carried me out and took me to the hospital. I never made a report of that accident to my superior officer that I remember of. I did not see the engine between the time I was hurt and the time it was repaired. (Mr. Ware handed a document to the witness, who identified the signature thereon as his signature. The witness stated he had forgotten about it, and that it was a voluntary statement.)

There being no objections to reading the document into the record, Examiner Rogers ordered the entire statement to be put into the record, as follows: Chicago, Rock Island & Pacific Railway Company; company's file no. 28–7665, regarding accident to J. B. Pool, at or near Komalty, Oklahoma, date June 28th, 1929; hour 9:50 a.m.; report of J. B. Pool, age 52. Made to R. F. Barry at Chickasha, Okla., on August 11th, 1928.

On June 28, 1928, I received an injury to my left knee. I was the engineer on ex–1402 at the time the injury occurred. The rest of the crew consisted of Fireman Harry Lillard, Conductor H. Geissler, Brakeman H. H. Goodger, and Brakeman E. E. Walters. We had a hold of two or three cars and we were making a main-line movement between Hobart and Komalty and the air was coupled up on the train and working O.K. To the best of my knowledge

I was setting on my seat box ahead or to the east of, the train was moving toward the east. I must have had my left knee just about on a line with the reverse lever. When we were about a mile from Komalty the reverse lever flew back and struck me on the left knee cap. We were running along about 15 or 20 miles per hour, I heard a sound that led me to believe that one of the eccentric blades had broken and dropped down, I immediately reached over and shut off the steam and applied the air and about the time I applied the air the reverse lever flew back. The lever came back as I was reaching over to shut off the steam. I was struck along by the
271 side of the head on the left side and on the left shoulder, the blow glanced my head and took off my reading glasses that I was wearing. My head wasn't far enough to the left that the lever hit me square, the lever just skinned the left side of my head. My shoulder wasn't hurt much, just bruised and sore for a while, it is all well now as is my head. My left leg must have been extended almost straight ahead as the reverse lever hit the knee square. The lever cut about a five-inch wound in the knee, the wound being straight up and down and about in the middle of the kneecap. The kneecap was cut in two. The train stopped in about three car lengths after the air was applied. As soon as the lever hit my knee I told Fireman Lillard that I had broken my leg, he thought I was joking until he came over and pulled up my trousers. The conductor and both brakemen came up and we decided to back back to Komalty. At Komalty we got the section gang to go back of us and flag and we backed on into Hobart where an ambulance met the train and took me to the hospital.

Dr. Miles operated on the knee on June 28th. He told me that it was necessary for him to drill some holes in the kneecap and put some screws through the kneecap. I stayed over to Hobart in the hospital and then came over here. Dr. Livermore has been treating me over here. I am going to try to return to work in about a month; I don't know whether the doctor will let me return to work then, though. The wound in the knee is fairly well healed up, but my kneecap is so stiff and sore, or rather my knee is, that I can hardly bend it. The doctors seem to think I am making a good recovery and I feel the same way, it is hard to tell just how soon the knee will be all right or if it will ever be all right.

I wasn't in a condition to look the engine over and all that I know about what happened is hearsay. I have been told that the
272 spring hanger on my side broke and let a spring out, that is about all that I have heard. There must have been something broke on the engine or something caught in it to make it fly back. At the time I heard something break we were just riding along and hadn't hit any exceptionally bad track. The air wasn't applied on the engine until after I heard the noise that led me to believe something on the engine had broken. After the noise it seemed as though my side of the engine stopped and the other side went ahead.

The fireman and myself were the only ones on the engine. The fireman was sitting on his seat box at the time the injury occurred.

This is the first trouble that I have ever had with my left leg. During my period of service I have had two claims.

I don't know what caused the accident. I am positive that it wasn't caused by anything that the fireman or myself did. The accident must have been caused by a break in the machinery. I feel that the company is responsible for the injury. I haven't made up my mind what I think the company should do, I don't know as yet how my leg is going to get along.

J. B. POOL

"By Mr. WARE:

"Q. The portion of this report which I would like to read to you is this, Mr. Pool:

"'When we were about a mile from Komalty, the reverse lever flew back and struck me on the left kneecap. We were running along about 15 or 20 miles per hour, I heard a sound that led me to believe that one of the eccentric blades had broken and dropped down, I immediately reached over and shut off the steam and applied the air, about the time I applied the air the reverse lever flew back.'

273 "Examiner ROGERS. The question is, Mr. Witness, whether what Mr. Ware read makes you remember what the cause of this accident was.

"The WITNESS. Only from hearsay."

I made the statement that I heard a noise which I thought was an eccentric blade broken off, and stopped the engine. It was just a noise—I do not know just how to explain it. I could explain it to an engineer who has been on an engine which dropped blades and the like of that, but I do not know just how to explain it to you. I was going along, and when an eccentric blade drops, it throws the thing on one side and stops your exhaust. It happened very quickly. All that was done in almost an instant. I do not think the eccentric blade did drop. I never told them that an eccentric blade dropped. The break, or whatever happened, reminded me of that. It broke about a second before the reverse lever broke. The engine, I suppose, had to make a half-stroke. The reverse lever did not break, whatever it was that broke. I do not know whether anything broke or not. As well as I remember it, I believe I stated that just after I heard this noise I reached over to shut off the throttle, and at that moment the reverse lever flew back. As to why I reached over to shut off the throttle when I noticed that noise, I will answer, I knew there was something wrong. It was all at one time and there was no time to do anything. If I had known it was going to come back I would have jumped, but I did not have time. I do not know that I can locate that noise. It was at the front end of the locomotive underneath the boiler. It was just a rumbling noise. The engine started working hard. It changed the motion of the valve and made

the engine exhaust hard. In my experience as an engineer I have experienced a locomotive reversing itself when nothing had broken about the engine, but I cannot just recall the time. I have
274 seen the time when a lever would not latch. The latches down into the quadrant would not catch, and the reverse lever maybe would make a stroke or two backward and forward before the latch would drop. I mean clear backward and forward. You would have to hold the lever until you got the ratchet down. By "backward and forward" I mean from one end of the quadrant to the other (T. 1067–1085).

I related another accident in which I was ruptured due to the operation of the reverse lever, which happened four or five years ago. I did not make a report of that accident. I took a medical examination by Doctor Newman on November 19, 1930, and he discovered the rupture. I did not tell him the cause of it and he did not ask me. I stated that the cause of the accident was due to the fact that the reverse gear was working hard when I was pushing it down. I do not remember whether the steam chest was full of steam or not. I stated that I gave the engine steam and it did not start, and this would indicate that the steam chest was full of steam. As to whether I opened the cylinder cock, I will say that I might have, but I do not open the cylinder cock every time we move, and I gave the lever a push. I might have opened the cylinder cock and reduced some of that resistance force on the lever (T. 1085–1087).

The seat on the locomotive on which I was injured on June 28, 1928, was a drop-seat. It was about fourteen inches wide and twenty-two inches long. The dimension of 22 inches is the distance that the seat extends out from the side wall of the cab, where it is hinged, toward the quadrant. It does not go up against the cab wall. There is a distance of a couple of inches next to the cab wall where it is hinged. On these engines the quadrant is pretty much in front of you, the front end over here, and the back end comes back within four or five inches of the front of the seat. The seat is not along-
275 side the quadrant but back behind the quadrant. As you sit on the seat box and face forward, there is nothing to the left of the engineer's seat except when the reverse lever is in the back motion it would be on the left side of you. That is, not clear back to the side, but would come back along to here [indicating]. Some of them differ. On the particular locomotive on which I was injured, no. 1402, the quadrant sits pretty far back. The end of the reverse lever comes back to about my left shoulder when the engine is in motion. On that engine, if the engineer was sitting clear over in the corner, the lever would come alongside of him when it was in extreme backward position, but if he was sitting a little to one side it would not clear him.

By Mr. MOREHOUSE:

"Q. If you had been sitting on your seat, over next to the corner of the cab, you would have been out of the way of the lever?

"A. I might have gotten to the corner and been out of the way of it, but I was not there.

"Q. Is that what you call "in the corner", if you are sitting next to the cab window?

"A. Yes, sir.

"Examiner ROGERS. Was that a deckless engine?

"The WITNESS. No, sir."

By Mr. MOREHOUSE:

"Q. The position in which your knee was at the time of the lever coming back, then, was that you had it stuck out to the left, so that it stuck over the end of the quadrant?

"A. No, sir; I was sitting perfectly straight on the seat.

"Q. But you had your left knee over the end of the quadrant, did you not?

276 "A. You can sit on your seat and your left knee comes just about in line with the quadrant, sitting there.

"Q. That depends, of course, on whether you spread your legs apart, or whether you stick your feet straight ahead, does it not?

"A. Sitting in the ordinary way, straight on the seat box.

"Examiner ROGERS. The difficulty Mr. Morehouse is having, Mr. Witness, is that if the lever would clear your rump, why would it not clear your knees?

"The WITNESS. It did not clear my knees.

"Examiner ROGERS. Does it clear you, sitting on the seat, to your hips?

"The WITNESS. It does not come back that far, to your hips."

There is a foot brace on the front of the quadrant on that locomotive extending out laterally from the front end of the quadrant. The quadrant is about three or three and one-half feet long. On some of the engines you can use that foot brace and on some of them you cannot. There is a difference in the way a great many of the seats are hung. Some of them are hung ahead and some are hung on the back of the cab. I do not remember about it on engine no. 1402. I do not remember whether it had a foot brace. I do not know what the distance was on that engine between the quadrant and the side of the cab. There was a stop block on the rear end of that quadrant, but I do not know just how far back. When the lever was in the extreme rear position and I was sitting facing forward on the seat box, I indicated a while ago that the top of the lever would come back to the left and opposite my left shoulder.

It was a straight and not an offset lever. When I am sitting

277 in the cab the lever is not any closer to me at the bottom, where it goes through the cab floor, than it is at the top where the handle is. When it is on center it extends straight up and down (T.1087–1093).

When the reverse lever would get to jumping I have often opened up the lubricator. When I say "get to jumping" I mean the vibration of the lever backwards and forwards. When they get to

jerking, and jerking too hard, they are liable to come unlatched. When I hear them begin to vibrate or jerk in that way I usually adjust the lubricator so as to give the valves more oil. Sometimes that clears up the condition of the lever and sometimes it does not. I could not say how long it takes when it does clear it up, but sometimes it might take three, four, or five miles or longer before you got the engine lubricated. The lubrication will not often get down there within a half mile. I could not say how long it takes to get enough lubrication down there to relieve the vibration of the lever. I spoke of the fact that I would have to move the reverse lever from front to rear, or rear to front, five or six times in picking up a car. Assuming that there is a place where I have just come in and stopped, and the lever is in forward motion, and assuming that I cut my engine off, go forward and then back in on a switch, pick up a car, pull on the main line, back on to the train, I count the following throws of the lever. I nearly always have to reverse the engine before I can cut off the train, giving them the slack would be one throw; throwing it ahead two throws; getting the switch and coming back three throws; backing up to the car if you can get it coupled and going out would be four; coming back five; and leaving town would be six. I would say, in picking up one car we would throw the lever five or six times and that is assuming
278 that I have to move the lever to slack my engine before I can get uncoupled. If it would take three or four times in getting it uncoupled, it would be more than that. My sixth count also includes throwing the lever to start to pull the train out of town, after I had picked up the car (T. 1093–1096).

I had used engine no. 1402 prior to my accident. My knee did not come in contact with the lever at any other time that I remember of. As to why it did not at the other times, I suppose I was standing up switching. As to whether I have ever reversed the same engine since then, sitting down, I will say I do not remember whether I have ever run that engine since that day. Prior to the accident I do not remember whether I have ever reversed the lever to the extreme back position sitting down (T. 1096–1098).

EARL WALKER, a locomotive engineer employed by the Chicago, *Rock Island and Pacific Railroad*, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Liberal, Kansas. I was hired as a fireman in 1913 and promoted to engineer in 1917. The territory through which I run is from Tucumcari to Liberal and I hold rights from Liberal to Amarillo. At the present time I am engaged in switching service at Liberal, Kansas. I have had experience in both passenger and freight service. In my territory we use a class 31 engine, which they call the 1800, a 2–8–0 type, weighing 127,000 pounds on drivers, manually reversed. In our yard we have a power reverse engine known as the

400, or 39 class, a 2–8–0 type, weighing 182,000 pounds on drivers (T. 1098–1100).

With reference to the 1800 class of switch engine, manually reversed, the lever works along the side of the boiler. I believe the back end of the quadrant is about even with the back end of
279 the boiler. When the lever is in back motion it would be a little back of the seat box. When I am sitting on the seat box in my usual position, with the engine in motion, if the lever should come back to the back corner, I would be in the way of the lever.

"By Mr. McLaughlin:

"Q. What part of your body would be?

"A. About the left shoulder. It would lack about 7 inches of clearing.

"Examiner Rogers. Do you mean by that, Mr. Walker, that you cannot get over on your seat box toward the side of the cab and be out of the way of the lever?

"The Witness. No, we are in the path of the lever.

"Examiner Rogers. Even when you are sitting over on your seat box as far as you can get, Mr. Walker, toward the cab?

"The Witness. When the window is closed (T. 1100–1101)."

In operating the manual lever in yard service, under a good many conditions the lever handles very hard. The causes I have in mind which create that condition are: improperly adjusted counterbalance spring, or dry valves which are generally caused from dirty boiler, or tight fitting bearings in the valve motion. In the winter time the lever handles considerably harder on account of the oil in the bearing and valve motion being cold. This occurs from about freezing on down. We have considerable difficulty with the engine foaming in yard service; a great deal of trouble (T. 1101–1102).

I was injured by being struck by a manual lever on February 2, 1929, at Liberal, Kansas, when I was running engine no. 1873, a type 31 switch engine, weighing 127,000 pounds on drivers, equipped with Stephenson motion and slide valves. We were moving forward with about ten cars and I had received a stop signal
280 and had gotten down to about three or four miles per hour, and the lever flew back. It was in forward position before this happened. It flew back and hit me in the left side. I had no warning whatsoever that the lever was going to fly back. I received a rupture and was operated on for it on February 19th and was in the hospital twenty-two days. I was off duty altogether ninety-one days on account of this accident. The company paid me $663.00, or full time and also paid my hospital expenses. I had observed the condition of the quadrant and latch on this locomotive prior to the accident and found nothing wrong with it. Prior to the accident the valves were lubricated. The cause of the lever striking me was that the spring stem equalizer broke and let the driving spring fall behind the eccentric, and it fell between the eccentric and mud ring

and wedged there. I inspected the engine after the accident and that is what I found. I have not had any other experiences of being struck with the manual lever (T. 1102–1105).

I have had the manual bar get away from me while I was handling it, and have in mind that about two months ago the lever failed to latch and I was working with it trying to get it latched, and ran through a switch. I was trying to get the lever latched and that had my attention (T. 1105–1105).

In my experience in yard service I have occasion to reverse the engine between 20 and 30 times an hour. Our shift is eight hours. We will probably have 30 to 45 minutes when we are idle during that time, including our meal period. In coupling up passenger trains, the operations performed with the lever are as follows: we head against the train and then make a cut; reverse the engine; back up; go forward; put the engine in forward motion and go forward; couple the engine to the diner; reverse the engine; back up; and put the engine in forward motion and go against
281 the train and then pull back to see if we have made the coupling—that is another motion on the lever. We will make the coupling about eight or nine times out of ten, but when we do not make it sometimes we have to make two, three, or four attempts. Each time we make an attempt we have to move the reverse bar from one extreme to the other twice (T. 1105–1106).

I have had experience with Alco power reverse, and have not had any difficulty in reversing an engine equipped with Alco gears. I have no difficulty whatever with a power reverse engine which is foaming in yard service. In making either a back up or forward movement on an engine equipped with power reverse, my experience as to my ability to keep a look-out while handling the power gear is that it requires no attention; you do not have to look at the reverse gear. With manual reverse my experience is that you have to put all your attention on reversing the engine (T. 1106–1107).

CROSS-EXAMINATION

I am thirty-nine years old. I have been an engineer for fourteen years but during this time I have been firing probably two or three years and have done some hostling during that time. Probably one-fourth of my experience has been with power reverse. I first started operating that type of gear shortly after I was promoted in 1917. I have reversed an 1800 class engine while sitting on the seat box with the window closed. The switch engines, as to which I testified the levers are hard to work, weight 127,000 pounds on drivers, and are equipped with Stephenson motion and slide valves. I have operated a Walscheart motion with piston valves. I would say an engine with piston valves handles some easier than one with slide valves with steam in the valves. I do not know whether the type of valve gear, whether Walscheart or Baker as compared with
282 the Stephenson motion would make much difference in the

handling of the lever. The slide valves are harder to handle in connection with the lever than piston valves, especially if there is steam in the cylinders, steam in the valves or steam chest. If the steam chest is not filled with steam I do not know that there would be any difference (T. 1107–1110).

With reference to my accident which occurred on February 2, 1929, on engine 1873, I made an inspection of that locomotive prior to the accident and found no defect. As to whether I considered it safe to operate, I would answer "No." I have always considered the 1800's as dangerous, always considered them as "death traps." I make that statement because there is such a little clearance between the lever and the cab. You are pinned in where you cannot get out in a hurry. I am referring to the portion of the cab where we sit. I have an idea that engine was built about 35 years ago. After the accident I made an inspection of the locomotive. In my opinion, the accident was caused by the stem breaking and the defective condition of it. The accident was not caused by any inherent defect in the reverse lever or reach rod, that I know of. This is the only injury I have had in my experience as an engineer in operating the manual lever. At the time I spoke of, when my manual bar got away from me, and failed to latch and I ran through an open switch, my attention was engaged on getting the latch to engage. The lever was flying back and forth, moving back and forth. I was not trying to stop prior to reaching the switch. I did not see the switch before I undertook to latch the lever. I have worked in that yard since I was promoted, and was familiar with all the switches. I was not trying to put the reverse lever in back motion to stop the engine. We were backing up. I was disciplined for having run through that switch. My engine was light, moving backward. We had just started to back up and the latch had not latched at all. I had not noticed it
283 until that time. We were about six car lengths from the switch when we started to back up. The lever was in the backward corner when we started to back up, and I had just thrown it there. The latch did not engage in the teeth of the quadrant, but I did not know that at the time I first started to move. I suppose we had moved two or three car lengths before I discovered the latch did not engage. I suppose the lever had moved in the meantime but I was not looking—I was looking out of the cab window. When I looked back in on the lever I noticed it was hitting against the back of the quadrant. That is what I mean when I said it was moving back and forth. It would move back and forth from the rear end of the quadrant perhaps eight or ten inches. I had not heard that noise or bumping before I looked back into the cab. That is what attracted my attention. I was then about three car lengths from the switch. Before I looked back into the cab I was not looking toward the switch. We were just coming out of the track and the switch was not yet in sight. There is a curvature of the track there and the switch stand is on my side. When I saw the lever was mov-

ing back and forth at the rear of the quadrant, I first tried to get the latch engaged. I found that it was stuck so that it was held up away from the teeth of the quadrant. There was no reason why I could not have stopped my locomotive before trying to get the latch to engage. While I was working with the latch I momentarily lost track of the distance to the switch and ran over it (T. 1110–1117).

I have had experience with the Alco power-reverse gear during about one-fourth or one-fifth of the time I had been running an engine. Over the last ten years, about one-fifth of my time in yard service has been on power-reverse engines. I do not know that I had ever had any trouble with the Alco gear creeping in road serv-
284 ice. I do not recall any such trouble in yard service with power gear. I have reported a slight defect but I do not think it was creeping; it was a leak. It was probably two or three months ago and it had no effect on the operation except using a slight amount of air. I have only one occasion a day to put a diner on the passenger train of which I spoke. I have been operating engines of the 1800 or 31 class for about four years (T. 1117–1118).

C. P. YOUNG, a locomotive engineer employed by the Great Northern Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at White Fish, Mont. I was injured by a manually operated reverse bar on January 26, 1929, at Stone Hill, Mont., in passenger service. I was using a 4–6–0 type engine, weighing 112,000 pounds on drivers, engine no. 905. I just shut off to make a stop at Stone Hill station. I reached up and dropped the lever down to about half stroke, and got over against the window to make the station stop. The reverse lever went back into the back corner striking my knee a glancing blow on the side and turning me around. It caught my overalls and turned me around. We were getting close to the station. I reversed the engine and stopped at the station. I imagine I was running between 30 and 45 miles an hour at the time of the accident. My legs were badly bruised and a blood clot was formed on the knee cap, and it swelled up twice or three times its natural size. I was off duty twenty-five days because of that injury. The company paid me $150.00 which was not full time but the price I set myself. The seat box on that engine is pretty well back. There is probably two or three inches clearance between the lever and the seat box. This engine has Stephenson motion and slide valves. As to whether I made any inspection of the engine after the accident, I simply walked
285 around the engine to see if I could see which side it was on. I didn't know what the trouble was and I never ascertained what caused the lever to fly back except what I was told (T. 1118–1123).

CROSS-EXAMINATION

After the lever flew back and hit my leg and caught my overalls, I then put it forward. The steam was shut off before it flew back. The engine was drifting. I just left it shut off and stopped at the station. I just shoved the lever over into the front corner and it worked pretty easy going ahead. Before we stopped at the station I made that one motion. After that I waited for a signal. I wanted to see if the engine would move itself. I didn't know just how much damage was done. I got a signal to start and the engine started but it was too lame to go, and we pulled in and backed into a side track. I found that the engine had broken a rocker box, and there were other things I did not see that contributed to the lameness. The rocker box takes the motion from between the frame and the outside of the frame. There is an arm on each side of it, that is, each end. One arm is down and the other is up. One arm goes to the extension to the link motion and the other goes to the valve stem and it takes the motion from the inside of the frame to the outside. This box was broken clear across. The rocker box is a device consisting of a bushing with a shaft through it, and is a part of a valve gear mechanism. I did not afterwards see the valve or the pressure plate or the interior of the valve chamber on that locomotive. It was an E–3 class of engine. That particular engine was held for the purpose of serving as a relief engine on a run where a gasoline motor car was ordinarily used. It was on the main line in local passenger service. It would not be used more often than once a week.

286 That is the only one of that class of locomotives which the company has in service in our territory. It is one of the oldest engines they have in service in my territory and the lightest engine we have right now. There was a foot brace fixed to the front end of the quadrant and extending out toward the side of the cab. It was big enough to put your foot against. I don't know about how wide the seat box is on locomotive no. 905, but I presume it is twenty-two inches. As to whether there is room to slide your foot back and forth, between the seat box and lever when the lever is brought back alongside of the box, I think you could get your foot in there if the lever wasn't there, but I don't think you could with the lever there. However, when I got caught, my foot did not get in there. I had my leg outside of the box. As to whether it was not necessary for me to do that, if I had known the lever was coming back I would have been leaving and would have kept my legs out of the way. There is lots of room between the quadrant and cab. I am sixty-two years old, and commenced running an engine in 1901 and have been running continuously since (T. 1123–1130).

NICK W. BRANDT, a locomotive engineer employed by the Chicago and Western Indiana Railroad, was sworn and testified as follows:

DIRECT EXAMINATION

I live at Chicago, Illinois. I hired out as fireman on the Chicago and Western Indiana Railroad in 1915 and was promoted to engineer in 1918. Our road is a terminal railroad and we have quite a bit of suburban service. We handle all passenger equipment for several railroads and also switching industries. My experience has been in all classes of work that our road performs.

We have three types of hand reverse gears: One type that extends in front of the boiler; one that extends half way between the side of the boiler and the rear; and the other that extends
287 clear on the side of the boiler to the left of the engineer and to the right side of the boiler. We have a 2–6–2 engine, weighing 136,000 pounds on drivers, a 2–6–0 type, weighing 166,000 pounds on drivers, and an 0–8–0 type, weighing 216,000 pounds on drivers, and an 0–6–0 type, weighing 164,000 pounds. We have the Baker and Stephenson valve gears and the Stephenson engine has slide valves, and the Baker piston valves (T. 1130–1132).

On the majority of our engines the clearance of the lever at or near the boiler is from one and three-quarters to two and one-quarter inches at the most, that is, from striking your hand or any part of you against the boiler either way. On the 0–6–0 engine you cannot run in any position except straddling the lever while making backward movements. We have a small steel seat box about 20 inches wide. The reverse lever slides within a half inch to sometimes scraping the box, and when you are making a backward movement you have to straddle the lever at all times, that is, have it between your legs. Your back would be against the cab window and one foot on etch side of the quadrant. If your legs are long enough I believe you could put them ahead of it. The lever at all times, while I am switching in backward motion, is between my legs. When I am running ahead I will sit in this position [illustrating]. The lever would come about to my knees. In forward motion it lies about two feet from me but when I hook it up close to center it is very close to my knees. But when I go to reverse it in backward motion, it would scrape the side of my body so I would actually have to run around this way [illustrating] and throw the lever and carry it between my legs to make a backward movement. When I am straddling the quadrant, the majority of the time I have my right foot on the front end of the quadrant when I turn around. My left foot will be just about the other side of the quadrant. The quadrant comes close to the end of the cab. My left foot is
288 across the quadrant towards the fireman's side of the cab sometimes. The lever is in between my feet. When I am operating the engine in that position I have to reach across the quadrant in order to handle the brake valve. The reverse bar is three and a half feet above the quadrant. When handling the brake valve the reverse valve would actually strike my arm if it should move.

If it should move either way it would strike my arm. My arm extends below the reverse lever. I said that was my usual position in handling the engine in switching service. I have observed that other engineers handle the lever exactly the same. This testimony applies to the lever on the 0–6–0 type, engine numbers 230 to 235. I believe I have observed my road foreman on the engine handling the lever in that way. He has often ridden with me and seen me handling the engine that way (T. 1132–1136).

We do not have the same condition on any other of our engines. On the other classes of engines you have plenty of room to reverse your engine and the reverse lever goes to the back end of the boiler. It operates towards the tank and toward the front end of the boiler (T.1136–1137).

There are quite a few jobs where a man will have to reverse his engine fifty and sometimes more times an hour in passenger switching. All switching jobs maintain that average about six hours a day, and two hours in transfer work. In transfer work I should judge you would handle the lever either in hooking up or reversing the engine about fifteen to twenty-five times an hour, according to how many stop boards and blocks you run against. A transfer run consists of going to the station and taking hold of a C&EI train and doubling to a Mono or an Erie and taking from fourteen to nineteen Pullman cars back to the yard, a five-mile run. These roads have different air pressure in their train line, and when you make these different couplings you will take slack and
289 want to start it but can't, and will apply your brake and reverse your lever and try again. When we finally get started we will probably go a short distance and get a block signal against us, which is the regular occurrence. We will have a railroad crossing at which to make a positive stop, and a few more cross trains which might have a board against us, and then an interlocking tower at which a majority of times we will have to stop. The number of times we have to stop depends on how the boards are lined up for us. In the yard we have to throw each train to a different yard separately. It is always extra movement with the lever (T. 1137–1139).

In passenger switching it takes all the strength you have, the majority of time, to throw over the lever, and I sometimes have to have assistance. After about six hours of operation on that lever I am just about half played out. I attribute that condition to stiff handling of the reverse levers, having steam in the valves most of the time, the valves being dry, leaky dry pipes, oil holes in the winter time frozen up or stopped up with dirt, which is a usual occurrence from men blowing out cars while we are working (T. 1139–1139).

I was injured in reversing an engine with manual gear on January 7, 1929, in passenger switching in the North coach yard. I was handling engine no. 215, a 2–6–0 type, weighing 166,000 pounds on drivers. I was throwing the lever in forward motion. It was very hard to throw over. I got it about the center and it made one lunge and sprang away from me against the boiler, striking my

hand against the drain pipe or gauge cock. There wasn't enough room to move my hand away from there at any time. It could not have been more than one inch clearance between the end of the lever and the drain pipe. It cut my knuckles open and caused lacerations on the back of my hand. I was off duty 32 days on account of that accident. The company paid me $232.00, or full time. After
290 the accident I inspected the reverse gear and the quadrant and found that a stop block we have in the front end of the quadrant was missing. It was dark and I did not notice it until I had my hand dressed and came back. With the stop block in place there would not have been any more than an inch more clearance, or about two inches altogether. I did not observe anything else on that engine that evening. I had so much pain; that was all I found. That reversing gear had been handling rather hard prior to the accident. I looked at my oil and examined the engine several times and could not find out why it was handling hard until I got hurt. About two weeks ago I happened to have the same locomotive. I touched the latch and the reverse lever sprung from forward motion clear into backward motion just by touching the latch, which showed that the counterbalance was not adjusted properly. I told the man who relieved me to report it (T. 1139–1142).

I have been injured on other occasions in handling a manual reverse bar. In July or August 1927, I was trying to throw over the reverse lever on a 2–6–0 engine, weighing 166,000 pounds on drivers. I pulled the lever half-way back and the pressure was so great that my foot slipped from the boiler head. At the same time the lever wedged my foot against the side of the boiler, injuring the arch of my foot. I had my foot over the brake valve on the center of the boiler, pulling the reverse lever (T. 1142–1143.)

I witnessd another accident when I was firing in which engineer George Thomasson was injured. He was running a 2–6–0 engine of the same type. He was running at a speed of about 30 miles an hour and wanted to hook up the lever a little higher. He took hold of the lever. I was watching him closely at that time and he tried to raise it and it dropped out of his hand and went down, crushing his foot. He asked me to come over and help
291 him. I tried to raise the lever but to no avail. He hollered at me "Stop the train or put on the brakes or help me." I had done all I could and I stopped the engine and pulled the lever up and helped him remove his shoe which he had to cut off his foot. He was in awful pain. I don't know whether he was relieved immediately or within an hour or so, but I know he had relief come. His foot had swollen so fast that he had to cut the shoe from the foot. His foot was crushed. When the lever went to the corner, crushing his foot, it just stayed there and pounded against his foot. It just jarred itself and pounded. When the lever drops down while you are going at any rate of speed, we have noticed with all our superheated engines that it is impossible to take them from the corner unless you come to a stop (T. 1143–1145).

In road service I have had several occasions when in trying to drop the reverse lever it got away from me and went into the corner, and I had to come to a stop in order to adjust it. Running at 25 or 30 miles an hour the reverse lever is a continual jar or shake which gets on a man's nerves. It is caused by the quadrant notches being worn and the spring being worn in the latch lifter and the pins and cotter keys. It is hard at times to hear when a man is calling for signals (T. 1145–1146).

CROSS-EXAMINATION

As to whether, when the quadrant is not worn and the latch is not loose and the lever is in proper condition, they bother my nerves, I will say that the majority of times the quadrant will cause a slight jarring even when the engine is newly overhauled. When it is right alongside of the ear it works on a man's nerves, the continual noise of that shaking. There are other noises on a locomotive but not a noise like that alongside your ear when you have the lever hooked up. We do not use the whistle very much. We use the bell
292 nearly all the time but that is quite a distance out on the center of the locomotive, and that does not affect my nerves. The exhaust of a locomotive is rather loud at times, but that does not affect my nerves. The quadrant rattling is a sound that is in the cab, whereas the bell is outside the cab, and there is a great difference in the sound. The bell is actually the louder. When we apply the air brake we get a hissing sound, which is much louder than the sound made by the hand lever, but it is not very hard on the nerves. We have to reach over the quadrant in order to get to both brake valves, which are located to the left side of the engineer and the left of the quadrant; as you face forward in the locomotive they are at the rear end of the boiler head. On our 2–6–2 and 2–6–0 suburban engines the brake valves are located in front of the engineer's seat box, to the right of the quadrant. I was speaking of the 0–6–0 type where they are located so you have to reach over the quadrant to reach them. That is the only class where they are located that way. I do not believe that there would be sufficient room on the 0–6–0 class to put the brake valve in the same place they are on the others, in front of the engineer's seat box. They would not be convenient for handling the engine. You can't stand up on any of these locomotives switching. The distance between the quadrant and cab is twenty inches. On the 0–6–0 type, where I straddle the lever with my back against the cab window in back up movement, I cannot put my foot alongside the quadrant because the quadrant runs directly along the seat box. I put it sometimes to the rear of the quadrant and to the forward end of the quadrant. On these 0–6–0's, I do not believe you would have but a foot between the rear end of the quadrant and the rear end of the cab. When the lever is in backward motion you have no more than 18 inches clearance from

the back of the cab. When I speak of the 18 inches clearance
293 I refer to the distance between the upper end of the lever and the backboard of the cab. When the lever is in backward position the lower part of the lever extends forward at an angle and, at the quadrant, rests on the rear part of the quadrant. The quadrant is open. You can probably put your foot under if you don't watch yourself or take caution. By a quick movement you can catch your foot under it, or if you desire you can put your foot in the rear of the quadrant. Some of our locomotives have a little sheet-iron arrangement around the quadrant and we have sheet iron underneath to close up the whole quadrant according to which direction we move, which causes the lever to work hard because that is all binding there. So far as the guard to keep your foot from slipping under there is concerned, it need not bind in any way in order to keep your foot out. In switching in backward motion you have your left leg to the rear and your right leg forward towards the forward part of the locomotive, sitting on your seat box with your back to the cab window. The purpose of looking out of the window is to watch what you are doing and to see the signals and find out what the movements are going to be. You can do that very readily. You would be turning your head and looking over your right shoulder and you can observe anything to the front in the same way. In making the backward movement I sit at all times in that position on any locomotive. When sitting in that position at certain times I possibly put my right foot alongside of and parallel with the quadrant with my toe pointed towards the front of the locomotive. There is no physical reason why I cannot do that. The five engines of the 0–6–0 class are the only engines of that class which my road has (T. 1146–1155).

We have seven or eight jobs doing passenger switching where I estimate you would move the lever 50 times or more in an hour. That means in a seven or eight hour shift during the twenty-four hour period. These are jobs where the engine is switching
294 in coach yards. In joint yards, where the passenger equipment of a number of railroads is all handled in the same yard—our road does all the work for all of them. I would say we handle 15 or 18 cars in an hour (T.1155–1156).

All of the 2–6–0 engines have a stop block at the front end of the quadrant as standard equipment. With those blocks in place, we just about have enough room and no more to handle the lever without having our hands come in contact with the boiler head, pipes or other appurtenances. I think there should be more clearance there. Personally I have not made any complaints to my company and don't know whether any one else has done it. The date of the instance I mentioned on a 2–6–0 engine where I said I did not recall the engine number was around July or August 1927. I braced my foot on the boiler head. We had no foot brace. I have never requested any braces on these engines. I don't remember of any of the other men asking for it. Some men have made their own foot braces by nailing a block in the middle of the floor. I have tried working on an engine with such a block and found it was helpful in

some cases. In other cases I had to get up and throw the lever, walk over the quadrant and then get back and throw it back. That was because our locomotives, working with superheated steam, have steam in the valves at most times, and you cannot open the cylinder cocks because on some types of engines they blow straight out and some blow back, and you cannot see the men working on either side of the cars. In the yard there may be 500 employees working. You don't know when someone is working under the car and you can't open the cylinder cocks. The reason the lever works hard at all times is because there is steam in the valves. On some locomotives you would have to get off your seat and walk clear over the side of the lever and down to open the cylinder cock, and it would
295 take about one-third of your day in doing this. Some of our cylinder cocks blow from the side of the locomotive across and out, and some blow back. On the 0–8–0 type, they are all equipped to blow under the locomotive towards the opposite rail. As to whether with those that blow under the locomotive we do not have to watch out for men who may be standing around, I will say that superheated steam has quite a pressure and blows a great distance. You have to be careful at all times. Assuming the cylinder cock on the right side to be open, it will blow under the locomotive and out on the left side enough to bother someone on the left side of the locomotive; if a man was working on the next track, surely. I cannot see on both sides at all times and the fireman might be putting in a fire and I would be afraid to open up my cylinder cocks. The thing to do would be to put some sort of a shield to direct the steam downward towards the ground underneath the locomotive so that it could not possibly come in contact with the man on the other side. On the 0–8–0 locomotive the cylinder cocks are clear out of reach of the engineer, without his getting up and walking to the front end to open them. On the other type the cylinder cock controls are within easy reach of the engineer, right below his foot. They could extend the control of the cylinder cocks farther back on the 0–8–0 type and if that were done you could handle it conveniently (T.1156–1161).

As to whether the stop block could be set up in the quadrant a little higher to give more clearance between the lever and the boiler head, I will tell you that in backward motion our engines are loggy right now from putting blocks in and taking away the full lead of the locomotive. If they put in any more a man would have to reverse the engine to move one car. It would be necessary to move the location of the quadrant to get additional clearance. With reference to the injury to Engineer Thomasson, I would say it must have been around 1916 and it occurred on a transfer run. I shut off the throttle.
296 He asked me to help and I tried to move the lever and shut off the throttle, which made it more dangerous. I didn't know any better, but probably injured him more by shutting off the throttle and letting it pound. If I had applied the brakes I could have prevented more injury to his foot. We would have stopped the engine quicker and I would have gotten the lever back sooner. By the pounding which occurred after I had shut off the throttle I meant that the engine, if it drops to forward motion, naturally will pound against the front end. The lever will not latch itself in the quadrant but will

just lash itself out, flying back a short distance and then forward again, enough to make a pounding there. The boiler was behind his foot. The sole of his foot was against the boiler and the lever crushed against the instep and held it firm. I don't know whether it caught his heel, but I know it caught his foot because I remember his foot laying there and I was trying to move the lever and he was trying to hold it back to keep it from pounding his foot. He could not hold it back. He was trying as much as he could, using all of his strength to keep it from pounding his foot. His foot was about two and three-fourth feet above the floor. My experience with levers has been that when they go to the front corner they always stay there like that. My experiences of that character are on the 2–6–0. Engineer Thomasson's foot was badly bruised. I know he lost time but I cannot tell you how long. It was engine no. 215 which went to the rear corner when I touched the latch about two weeks ago. It worked that way all that day with me. The nut on the counterbalance spring worked loose and once in a while they catch on the housing when you go to throw them back, that is, the housing that holds the spring. When it catches there it works loose and when it is out of balance it will always have the tendency to go forward. That is what was wrong with no. 215. I did not have time to make any effort to adjust it. I used all of my
297 energy and strength to move it and the fireman helped me once in a while. As to how I happened to unlatch it with my finger in that way, I wanted to throw the lever to forward position and in reaching back to move the lever I just laid my hand against it and it happened to strike the spring, which is rather weak on that latch lifter. The lever started right ahead and went clear down to the corner and I did not even touch it. As to how long it would have taken me to tighten up the nuts on the counterbalance spring, I don't know. Usually if there is anything the matter with the engine where I have to crawl underneath the wheels, I do not take any chance on any tracks where there are engines working. It probably would take ten minutes to have it adjusted right. I did not ask for a relief engine. We have never had any power reverse engines on our road (T. 1161–1167).

298 OFFERS IN EVIDENCE

Thereupon there was offered by Mr. McLaughlin and received in evidence, the following exhibits:

Complainants' exhibit no. 1, being a diagram of the Alco type G power reverse gear (T. 1169).

Complainants' exhibit no. 2, being a blueprint showing the valve mechanism of the Alco power reverse gear (T. 1170).

Complainants' exhibit no. 4, being a blueprint of Franklin power reverse gear (T. 1171).

Complainants' exhibit no. 5, being a blueprint of the Franklin Precision power reverse gear, showing the hand wheel and indicator arrangement marked sheet C–38211 (T. 1171).

Complainants' exhibit no. 6, being a blueprint of the Franklin Precision power reverse gear, showing a slightly different arrangement of hand wheel and indicator, marked sheet C–38217 (T. 1172).

Complainants' exhibit no. 7, being a blueprint of the Franklin Precision power reverse gear showing the general plan and arrangement marked sheet G–38146 (T. 1172).

Complainants' exhibit no. 10, being a compilation of four sheets marked "Reverse gear situation as of December 31, 1930, of steam locomotives, developed by 157 replies to the American Railway Association, showing the number of engines equipped with power reverse, with manually operated screw reverse, and the number not equipped with either power or screw reverse gear." Mr. McLaughlin stated that this had been furnished by counsel for the American Railway Association at complainants' request and that counsel
299 for said association stipulated that this is a correct compilation of the returns and is binding upon the defendants represented by Mr. Thom (T. 1174–1175).

Complainants' exhibit no. 11, being 22 accident and injury reports of the Bureau of Locomotive Inspection relating to accidents sustained by men who were witnesses during the presentation of complainants' oral testimony, and whose names are set forth on the first page of said exhibit (T. 1175).

Complainants' exhibit no. 13, being index sheets consisting of nine pages and 231 copies of monthly reports of railway accidents made to the Bureau of Statistics of the Interstate Commerce Commission on form T, pursuant to the requirements of the Accident Report Act (36 Stat.L. 350; U.S. Code, title 45, sec. 38), being different reports made by the carriers of accidents suffered by engineers from operating the reverse levers. Mr. McLaughlin stated that this number comprises all of the accidents indexed by the Bureau of Statistics as a result of operating the reverse lever during the calendar years 1929 and 1930. Mr. McLaughlin further stated that in connection with these exhibits complainants have requested counsel for the carriers to supply the record with the facts as to whether the particular locomotives involved in the report were equipped at the time of accident with manually operated reverse or power reverse. Examiner Rogers directed the carriers to furnish a list covering the accidents in said exhibit showing whether the locomotives at the time of the accident were equipped with hand or power reverse gears (T. 1185–1193, 1204).

Complainants' exhibit no. 14, being the cut or picture on the outside cover of the pamphlet, marked "Bulletin 2010 Alco Reverse Gear"; the diagrams appearing on page 2; the cuts or pictures appearing on page 3; the cuts or pictures appearing on pages
300 4 and 5; the piping diagram and piston packing and piston rods diagrams on page 6; the diagram and list of parts on page 7; and the diagram and list of parts on page 8 (E. 1206).

Complainants' exhibit no. 15, being the pictures and cuts on page 2 and the pictures and cuts on page 4 of pamphlet marked "Bulletin No. 240, Franklin Power Reverse Gear." (T. 1206–1207).

Complainants' exhibit no. 16, being the pictures and cuts on page 2 and 3 of the pamphlet marked "Bulletin No. 241, Precision Power Reverse Gear, Franklin Railway Supply Company, Inc." (T. 1207).

Complainants' exhibit no. 17, being the cut on the outside of the first page, the diagrams on the second page inside, the cuts on the third page inside, and the diagrams and specifications on the back of the fourth page of this pamphlet marked "Barco Power Reverse Gears, Type B–4."

Mr. McLaughlin stated that he had a series of specifications of standard locomotives for the United States Government, which were prepared by the Railroad Administration during the period of Federal control and that said specifications covered the following types of locomotives: mikado type freight engines, weighing 220,000 pounds on drivers; heavy mikado type freight engines, weighing 240,000 pounds on drivers; mountain type passenger engines, weighing 220,000 pounds on drivers; mountain type passenger type, weighing 240,000 pounds on drivers; light Pacific type passenger engines, weighing 165,000 pounds on drivers; Pacific type passenger engines, weighing 160,000 pounds on drivers; light Santa Fe type freight engines, weighing 275,000 pounds on drivers; heavy Santa Fe freight engines, weighing 300,000 pounds on drivers; six-wheel switching engines, weighing 165,000 pounds on drivers; eight-wheel
300 switching engines, weighing 220,000 pounds on drivers; mallet type freight engines, 2–6–6–2 type, weighing 360,000 pounds on drivers; mallet type freight engines, 2–8–8–2 type, weighing 480,000 pounds on drivers. Mr. McLaughlin stated that in each of said lists of specifications appeared the following language respecting the equipment of the reverse gears: "Reverse gear; air-operated with provisions for steam. See supplement." The supplement in each of said specifications read as follows: "Power reverse gears; power reverse to have metallic packing rings so air or steam can be used without damage to packing. Bolting arrangements for holding gear in place to be uniform. The type of air reverse gear to be that which will prevent the locomotive from moving in a direction opposite to that which it is normal for it to do in the given position of the reverse gear." Mr. McLaughlin stated that he had been informed by Mr. F. P. Pfahler, who was chief mechanical engineer of the United States Railroad Administration during the period of Federal control, that all of the engines of the type specified in the specifications to which he had referred, which were built for the United States Railroad Administration during the period of Federal control, were equipped with power reverse, and that if Mr. Pfahler were here he would testify to that effect. Mr. McLaughlin requested that counsel for the carriers stipulate that if Mr. Pfahler were called and sworn that he would make the state-

ment which he, Mr. McLaughlin, had just made. The stipulation was agreed to by counsel for the carriers (T. 1108–1212).

Thereupon complainants rested (T. 1216).

A. R. McDonald, member of the Public Service Commission of the State of Wisconsin, which commission is successor to the Railroad Commission of Wisconsin, made the following statement: The Railroad Commission of the State of Wisconsin intervened in the
302 proceedings before you. I appear here as a result of unanimous action of the railroad commission, and on the request from the Governor of the State of Wisconsin, to ask this commission to do as much for the men who operate the locomotives in the State of Wisconsin as the legislature of that State did for them over eight years ago.

In 1923 the Legislature of the State of Wisconsin passed an act requiring the carriers to equip locomotives operating in that State with power reverse gears, locomotives of a given weight.

However, the action of the United States Supreme Court in the Napier Wisconsin cases held, as you are all aware, that the Interstate Commerce Commission alone had power to make and enforce laws pertaining to appurtenances on locomotives and for tenders, and thereby, of course, annulling the statutes adopted by the State of Wisconsin for the relief and protection of its railroad men.

For that reason, I appear here to make this request. We are not going to offer any testimony. We are going to adopt the testi-
303 mony introduced by the applicants, and will either file a brief at the conclusion of the proceedings or join the applicants in their brief.

Mr. Morehouse stated that he understood that the statement made on behalf of the Public Service Commission of Wisconsin by Mr. McDonald is not to be taken or considered as evidence or proof in this case, but simply a statement of the position of that party.

Examiner Rogers stated that it is merely an adoption by that intervener of the testimony offered by complainants.

Mr. McDonald replied that the purpose of the statement was to indicate that the State of Wisconsin had adopted a law requiring the carriers to equip their engines of a given weight with power reverse gears and that he would furnish, for the record, copies of that statute with ten days (T. 1216–1221).

*Motions to dismiss*

Thereupon Mr. Thom, Jr., renewed the motion which he made at the beginning of the proceedings, on behalf of carriers represented by the American Railway Association, for a dismissal of this case, on the grounds stated in the second supplemental answer of said Association and as amplified by Mr. Morehouse on the first day of the hearing, and further moved to dismiss the case on the ground that no violation of the Boiler Inspection Act has been shown (T. 1221–1222).

Mr. Miller, on behalf of 251 roads represented by him, renewed the motion which he had made for dismissal of this complaint on the ground of lack of jurisdiction and also on the ground that the testimony adduced by complainants does not show the violation of the Boiler Inspection Act (T. 1222).

304 Mr. Rodman joined in the same motion on behalf of the Norfolk Southern and the Carolina Railroad (T. 1222).

Examiner Rogers denied all of said motions to which ruling an exception was taken by and noted on behalf of Mr. Thom, Jr., Mr. Miller and Mr. Rodman (T. 1230).

Whereupon, Examiner Rogers directed the defendants to proceed (T. 1230).

DEFENDANTS' EVIDENCE

J. E. GELDBAUGH, locomotive engineer for the B. & O. R.R., living at Keyser, W.Va., and 55 years old, testified:

I was originally employed as a fireman, April 1, 1895, for the B. & O., and have not worked for any other railroad. I was made an engineer November 20, 1898, but have not worked continuously as an engineer since that time, but only since October 1907. I work on the west end of the Cumberland division between Keyser, W.Va., and Fairmont, W.Va. At present I work on pool or unassigned freight and have been in that service practically the entire time. During my period of service, I worked on the extra list, which would require me to run on all turns, yard turns, through freights, local, and so forth. I have had very little passenger service and six months in yard service. Pool freight service takes me into all classes of road freight service, such as time freight, way freight, and so on part of the time, but the run which I have been on now is slow freight, heavy coal trains; it is a through train.

Ever since the B. & O. adopted it, about 1913, I have had experience with power reverse gear. Prior to then my experience was exclusively with engines operated by manual reverse. From 1914 until about 1921, my time has been mixed. Sometimes I would have power reverse, and other times manual, but generally since 1920, it has been continuous power reverse, with the exception of less than 10 cases. My experience with the manually operated reverse gear include the screw type of manually operated gear, as well as the hand lever type. I have never been physically injured in any way by a manually operated reverse gear. I have always been equal to the occasion of operating locomotives equipped with manual reverse gear provided it has been properly lubricated and

306 equalized. I do not know what degree of physical exertion is necessary in those circumstances; it never really whipped me. By that I mean I was never physically exhausted from handling them. I have always been able to handle them. Sometime ago I found engines just released from the shop, which were stiff and the parts new, worked a little harder than if they were broken

in, but even as to them, to my knowledge, I never called on anyone else for help. As to how often I have had a new, stiff engine that worked harder than ordinary: If a man was running a locomotive regularly assigned, that would may be happen once a year, but if a man would be on the extra list, he may get two of them one month and may not get one for a year or so. That has been about my experience. At the present time the improvement in the condition of these new engines coming direct from the shops in recent years has been that we use to have to go to the shop and take them out ourselves, but not any more. They have a man used for that purpose, breaking locomotives in before they are released from the shop. On the last manual engines I handled they had men doing that work alone, who are called lion tamers. I do not recall any case of a hand reverse lever coming unlatched from the quadrant and going to the corner of itself, nor where the hand operated reverse lever cam unlatched in the quadrant and thrashed back and forth. I do not recall any case where, after I unlatched the hand lever, I was unable to hold on to it and it got away and went down into the corner (T. 1231–1237).

To operate the manual reverse gear would not take my vision away from the road longer than say ten seconds, and as a rule, when we have to look at our gauges or even blow out the water column, it would take as much time as it would to cut the engine back, and, as a rule, we look out ahead before we do that. With respect to
307 the matter of keeping a look out, I would say the time required was about the same whether operating the power reverse gear or the hand reverse gear. As to whether the power reverse gears will maintain a fixed position of cut-off of the locomotive when running: They won't always do it, according to my experience. They will creep, and there are times when you would start a train in the forward motion, extreme forward motion, and after you get the train started and pull the lever back to the cut-off to which you want to work her, maybe you would move along for a mile or two, and it would creep back, and you could feel the engine getting lame, and, naturally, you would take the reverse lever to give it a notch or two, and instead of taking the amount which you gave it, it would go beyond that, sometimes right to the corner. I have had them, when you would be running along say at 30 miles an hour, and you could not keep them out of the corner, without them coming back and cutting themselves out entirely. That particular experience has occurred during practically all the time I have been principally on power reverse gear engines; it happens say 70 or 75 percent of the time. I would get one engine that behaved all right, and the next three would creep. There is one type of power reverse gear on the engines I operated during the past ten years called the Molin, but I do not think we are using any of those any more. I have had more experience with the Ragonnet and Alco than any of the others. Those are the ones we have been using most of the time during the past ten years. They both seem to be equally defective in their

tendency to creep. I have noticed them to behave in other than the normal way in other respects. I would be running along and would look out and could hear by the engine exhaust that she was getting more steam at one time than another, and you could see it travel possibly an inch, the cross-head, see it travel that far on the guide,
back and forth. The cross-head is near the power reverse
308 air cylinder, and the piston rod is fastened into this cross-
head, and there is a guide which controls it. I mean the cross-head of the reverse gear and not of the engine. That is so located that I can see it from the engine cab only by leaning out. In cases where the power reverse gear cuts back so as to nearly shut off the locomotive, we try to drop the engine back to about the place where you had been working, you understand, but instead of that she would not stop at that point but she would go on to the corner. You could pull the bar back until you had it to the cut-off, where you wanted to work the engine, and she would repeat that same thing a half dozen different times, and you would get tired and drop it down ahead of that and latch it and work it with your throttle so as to maintain steam in your boiler and engine. In those circumstances it requires you to give more attention to your reversing lever than when operating with hand operated reverse lever. In case I then find I can't keep it back where I want it, that is, I cannot keep the lever set back so as to control the valve gear at the point of cut-off, we pull it back a little to where it would not creep back on us. That is hard on water and also on steam and coal. Those creeping gears might affect a slow freight train a little in keeping on schedule; I imagine a person with a faster run would have more trouble with it than I have. I have run on fast freights, and of course it would naturally affect me there. The creeping of those gears would worry a fellow when he could not maintain the proper cut-off, where he thinks an engine should be worked. During my experience in yard service, I do not recall any difficulty in getting or observing signals from the switchman or other signals, while operating with the hand reverse lever. In switch service, spotting cars with an engine equipped with a hand operated reverse lever, it is not necessary to reverse the engine every time you spot a car,
if you have an air-brake. You would have say 25 or 30 cars,
309 and they spot those cars about three and four feet apart, so
that the workmen can get around them, pick them up and make repairs. I am speaking of where they repair cars, that is what they call the hospital track. They would give you a signal to back up, and when you would move about two or three feet, they would wave you down near one and put on the brake and naturally let the slack run in, and they would want to spot the car. They would raise a release lever and give you a signal to back up again and you would do the same thing over again and spot 25 or 30 cars, without throwing the engine over. If you had a locomotive with no brake on, you might have to reverse. By "throwing the engine over", I mean throw the reverse lever. I have done hump

switching, and it depends altogether on the length of the train and on the size of the locomotive as to whether or not you have to reverse the engine every time you handle a car. I have had locomotives that were powerful enough for the train which I had to haul, and I would probably push a train with 30 or 35 cars over a hump without reversing the engine. At other times, when you push maybe three or four cars and you had an unusually long train, maybe they would not have any riders to push it, men riding the cars on the track, and when they give a signal to go ahead again, maybe I could not start it without taking the slack out with the reverse lever, and I would reverse the engine again, and maybe push six, eight or ten over again before stopping. The shorter the train, the easier it is. That happens with an engine unusually long train, or something of that kind, or where the engine is not heavy enough for the job. With the same class of locomotives where one would creep and one would not, under approximately the same tonnage and conditions, and I imagine it would necessitate the taking water where otherwise you might have to go by. I believe an engine with
310 a reverse gear which is creeping, uses more water than one where the gear does not creep. It would use more coal. When you set the engine with a manual reverse, that is, when you shut the hand lever at a given point of cut off, the whole lever, it stays there. I have had that same experience with the screw type of hand gear, which has some sort of an arrangement for locking the gear at a given point. It has a keeper on top which you throw over and latch. The wheel has a handle on it, and you reverse it with a wheel and throw the latch back when you get the engine set where you want to work her.

"Q. Based on your experience with the manually operated reverse gears, and your experience with the power reverse gears, what is your opinion, if any, as to which is the better, from the standpoint of economical operation of the locomotive?

"The WITNESS. Well, if you had a locomotive that you could maintain a proper cut-off on, I would say it would be more economical than one you could not maintain the proper cut-off on. In other words, you take one which creeps and it would not be as economical as one which does not creep, if that answers the question."

I have always been able to maintain the proper point of cut-off in operating locomotives equipped with hand reverse gear. There is no difference that I can see in the matter of safety between the manually operated type of reverse gear and the power reverse gear. I have not found anything unsafe or dangerous about the hand operated reverse gears which I have operated. I do not recall any conditions with respect to the hand reverse gears on the B. & O. coming under my observation that leads me to think that they are unsafe or dangerous in any way. Considering the difference in the types of the two devices, I have no objection as to whether the one or
311 the other is more likely to cause personal injury. I have had experience with operating reverse gears in extremely cold

weather; the division I run over is a mountain division, and the weather gets very cold in the winter, and I was troubled with the power reverse freezing up at times when the mercury was down to zero or below. In those kind of cases we had to thaw it out. By "freezing up" I mean there would be condensation or moisture in the atmosphere which would get in the cylinder, which is operated by air, and there would be enough cold in there to freeze it and hold it stationary, so that you could not operate it. We would hold a little fire under it on a piece of wire and thaw it out and then operate again. That would occur at points other than the beginning of the trip; at some points where we would stop for water along the road. I have had it happen at the beginning of the trip and also half way over the division again, on the same trip. When that happened, we could not operate the locomotive without thawing it out again. I could operate the locomotive in the direction that the reverse gear was in, but my train was back here and I had to get back to it and couple on some cars. I could not change the position of the lever until I had thawed it out. The only thing I could do was to keep on moving in the direction in which the gear was frozen. We could stand where we were. It would take us about 10 or 15 minutes to thaw out the reverse gear. I have had that happen twice on one trip. There is no way I could thaw the gear out or operate it again if it was frozen, without stopping the locomotive and getting down to thaw it out. The safety rules would not allow us to do that with the locomotive running. I operate out of Keyser in this pool freight service the Articulated Mallet type of locomotive. It is called 2–8–8–0. As to whether I prefer to have hand reverse gears on those Mallets as compared with power reverse: From a
312 physical standpoint I can handle a power reverse easier. I do not hardly think that a manual reverse gear would work on the Mallet, because we have two locomotives to one boiler. You could hardly get a man to work it. There would be too much gear there to handle. They have always had power reverse gears on the Mallet engines on the B. & O. I never experienced a hand-operated reverse gear freezing up in the winter time so that I could not operate it. I have observed the locomotives equipped with power reverse gears in the round house, when the air was being pumped up, when an engine was being made ready to go out on a run. At those times I have observed the parts of the valve motion or the valve gear move when there would be no one in the cab of the locomotive and no operation of the control lever or power reverse gear. There is a man who oils the air pumps. He would go around to oil these pumps, and he would close the pumps down, fill these oil cups, and he would drain the main reservoir. It would not take him but possibly three, four, or five minutes to do that. In the meantime, when the air would go off, this gear would settle down to the bottom of the links, you know. That would be the position permitting the engine to move in extreme forward motion or back; it would depend altogether

on what position it was in. It would move to one corner or the other. I have observed the die blocks going up in the links when he would turn the air on again. The radius rod is connected with that. I would see it creep back up in there a half inch at a time, and creep up to the position the lever was in when he closed the pumps down. I could not say what position that would be. It may be air cut out or partly in the forward motion or in the back motion. As a rule, coming out of the round-house, they generally have them in the forward motion, and I judge that is the position she would be in. I have observed that not once but many times. That has occurred without any movement or change in the position of
313 the control lever of the power reverse gear. That would occur when the power reverse lever was in the forward motion, as well as when it was in the center. If she would be one-half way down the quadrant, and you would close the air off, it would settle to some certain point there, and when he would turn the air on again, it would naturally go back to where it had been set. This is when standing, with the throttle closed and I would be oiling around. By air reservoir I mean where they drain the moisture out of them. They have a cock, with a slope at the bottom of them. We have instructions to drain them out twice on the division, in both directions, but it is a good place to drain them in the round-house, when there is any frost. It is warm in there and they melt, and naturally it would be a good place to drain them there. I do not remember ever having any power reverse gear that shimmeyed, but I have had them travel back and forth, as I have told you; that is I looked out the window and saw them traveling back and forth in the guide. That would not have any effect on the reverse lever handle in the cab; you would never know it unless you looked out and saw it (T. 1237–60).

As to the conditions on B. & O. locomotives equipped with hand reverse with respect to the clearances in the cab: I have always found room enough in the cab to operate one; also to sit on the seat. As a rule we inspect our locomotive before taking it out on a trip. On most locomotives equipped with hand gear, we are able to see the various parts of the reverse gear and its connection to the valve gear in making an inspection before taking a locomotive out. We cannot see all of the working parts of the power reverse gear from an outside inspection; there are some parts that are not visible to inspection. You cannot see inside of the cylinder or the valve, that is, that operates the valve gearing. It is the air valve that admits and lets out the air on the power reverse gear cylinder. From an inspection, I would not be able to tell whether it is a gear that creeps;
314 I would not know until I had run the engine a piece. I do not recall any instance at present of enginemen on the B. & O. who have voluntarily selected jobs running locomotives with hand reverse instead of jobs which they might have had on locomotives equipped with power reverse gears, but I do know of men who have taken jobs in yards where they had manual reverse, on either the

road engines or the yard engines. I do know of some cases where men took yard jobs who could have had a job on the main line with the same kind of reverse, the manual reverse. I say both engines had the manual reverse. The seniority of these men was such that they could get jobs on the road with power reverse gear. They took yard jobs in preference to road jobs. Some classes of service in road service have power reverse on them; there would be times that they would have the screw type on a local, you know, that is, a local engine; but the majority of the time they make an effort to have an engine on there that they can handle with power reverse. That would be on different ones in different parts of the territory I cover (T. 1261–1266).

CROSS EXAMINATION

I have been running regularly on the B. & O. since 1907. From then to 1914 all our engines were equipped with manual reverse. Around 1914 they began acquiring engines with power reverse, and they gradually acquired more and more of those engines, until at the present time most of the engines in our pool freight assignment are equipped with power reverse. I could not say whether the company has equipped some of its engines with power reverse which were formerly equipped with manual reverse. I do not know of any engine which I have worked which was formerly equipped with hand reverse that is now equipped with power reverse. I have had a few engines with manual reverse in ten years. Possibly,
315 I would say, less than ten that I might have gotten sometimes, but in the regularly assigned service I am in, we have the power reverse on them. I can't say as to the last time I had an engine equipped with hand reverse, at least 3 or 4 years ago. When I was operating a manual reversed engine and I wanted to throw her over from forward to backward motion, sometimes I stand up, and sometimes I sit. I would just stand up and grab the lever like this [illustrating] and throw it back. Our engines have a foot brace at the end of the quadrant; it makes it easier to operate, gives you better purchase. It depends altogether upon how that manual reverse was equalized. In the ordinary run of our engines, possibly we could reverse them without that, but it makes it easier to have it. Lots of times you can reverse an engine with one hand, but you can do it easier with two (T. 1266–1269).

I do not recall any occasion when I braced my foot against the boiler or the pipes or any objects alongside the boiler or boiler head. I don't remember any instance when I have asked the fireman to help me throw over an engine without his voluntarily coming and doing it himself. I have always been able to do it. Sometimes he might have done it, but I just don't remember. If he did come over it would be just to be a good fellow possibly. In my experience I have never had to call on the fireman, that I remember. Sometimes he would grab it himself, to help me out a little bit, not that I would

have to call upon him to do it. He didn't have to do it; he did it voluntarily. I would be sitting looking out for signals, possibly. I would get the signals before I would reverse. He would know when to pull the lever because I would tell him. He would come over and would grab the lever, and I would say "Throw her back," and I wouldn't touch the lever myself. He would do it voluntarily.
316 Maybe he would reverse the engine once or twice along there and step down again. Possibly he would have something to tell me. It is not part of his duty to do that. Possibly the fireman has handled the throttle for me. It would not be in the same way, because I would not then be sitting. I have often asked a man if he wanted to run the engine up the hill and he would sit down and rest himself, or something. I have done that. But under the ruling we have now we are not allowed to let a fireman touch an engine, not even handle her. It has been about 15 or 18 years ago since the fireman handled either the reverse lever or the throttle. My service was mixed 1913 to 1920, and I was on the extra list part of the time, and possibly I might have caught a local in the meantime which required some switching to be done. That would be the only time he would have an opportunity. If I was to give you a specific case of the time he did it I couldn't do that today. Now, I just remember that he has done it at times—not that I called upon him at all. He did it to be a good fellow; I have taken locomotives from the shop before now and would try to work with him. I mean this was an engine I was called to work in the yard this day and the lever was working so stiff I couldn't handle the lever and I took it back to the shop, and the road foreman had it corrected. I would handle it myself, but it was just a little too hard a job due to a defect. I think he said the pressure plates were lying down too close to the valve. I did not feel any strain that time the engine worked so hard, but I knew I had enough of it, and I called the road foreman's attention to it, and he told me to get another engine immediately, which I did. Any time that an engine comes with bearings on the valve motion or any part of the reversing mechanism tight, I imagine that would make the lever work harder on a manual reverse. I had that experience on a trip or two until an engine would get broken in. I don't recall having them longer than that
317 before they were broken in. A "lion tamer" is a man who takes engines that have undergone repairs and he runs them several miles, possibly 25 miles in each direction, and perhaps he will make 2 or 3 trips that way in order to get all of the parts broken in. Those parts are everything that have undergone repairs, all movable parts. It is not the movable parts that the reverse lever moves that needs breaking in any more than the valves or bushing or any other part. It might be possible that the bushings were lined too tight or not properly broken in. Naturally they would be new when they came out of the shop, but by seeing that the oil holes were opened on it and with an equalizing spring on those reverse

levers, if you have it properly equalized you can handle the engine all right. I have never found a case where it could not be done, if a man was assigned to a regular locomotive that he could not get that engine down to where he could handle her. I have never been regularly assigned as a "lion tamer." That is just a slang phrase, which I have not heard of until it was mentioned here in the last couple of days. On my road they call it just breaking in engines. They have never given me a helper when I got an engine new out of the shop. When I am on the road and hooking up an engine to handle the manual reverse lever, I put my foot against the brace at the end of the quadrant and pull her back, because I can do it easier. I have run lots of locomotives where I could hook the engine up without putting my foot there. I have done that. You would hardly get a speed of 40 or 50 miles an hour if the engine was in the corner, or the lever. You would naturally pull her back before you get to that speed. I have never had any fast runs, but I have hooked them back running about 35 miles per hour. As to whether I have ever done that without bracing myself, it would depend upon how the reverse lever was equalized. I have seen them that I might turn the spring up far enough so that they would come back themselves. I would push them down. You know you can screw that spring up tight enough; and it would require much more physical effort to push them forward as it would require to pull them back before it was tightened up. Just to equalize them in both directions—this spring is in there for that intention. I am talking about the counter-balance spring; something to offset the weight of the valve gear. They will work harder in one direction if you screw them too far in the opposite direction, in which case you have to exert more than normal force. If a man was running a regular locomotive he would naturally find it. If he would be going west one trip he would find out he would have this spring tightened up a little too tight, and possibly he would slacken it off to take care of it. They have regularly assigned locomotive on locals and pick-ups, but today most engines are unassigned in pool service. Through freight service are mostly pool (T. 1269–1277).

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I don't think I have ever run 50 miles an hour on freight trains; possibly I have gone 40. If I wanted to drop her down a few notches, with the high speed, I would sort of brace myself because I could do it easier; beyond a doubt that is the only reason; it may be safer, too. As to whether there is a pull on that lever: It depends altogether upon how the lever was equalized. If it was properly equalized, even though going 40 miles an hour, it could be done without much effort. There might have been some engines that I got that were not properly equalized some years ago. I have not had any experience in the last ten years with manual reverse levers. I have not forgotten what went on ten years ago. I found some that worked, an unusual situation when they just came out of the shop. That has been quite a little while ago. You see, they put a

man on to take care of things like that and break in these engines.

I will say that prior to the last ten years, I did have some
319 engines that were not properly equalized and properly lubricated. In such cases it would be harder to operate the reverse gear, and I would have to brace myself against the brace to handle it easier. I cannot just say if it was in order to handle it easier or to handle it at all. There are some cases where I don't think I could have handled it under those conditions standing flat-footed on the deck without bracing against anything. If I disengaged the latch of the lever when it was hooked pretty well up the center, running 40 miles an hour, and let go of the handle, it naturally would go to the corner. So there is some force that takes the lever to the corner when you disengage the latch. As a rule the latch will catch. We would just drop it down possibly a notch or two, just reach over and drop it down a notch or two at a time. If I kept hold of the latch and kept it disengaged, then the lever would have a tendency to draw you to the corner, but I would not do that; I would let loose of the latch and let it catch in the quadrant. I don't recall any cases of the lever going to the corner by itself or get away from me. It may have happened sometimes; I do not recall. With power reverse, when running along 40 miles an hour, and you want to hook up the engine or drop her down a few notches, you can do that with one hand (T. 1277–1282).

We generally look where we set the lever, the same as with the manual. That takes just a glance. If you are hooking up with the manual lever, it would be necessary to go over from the window and get hold of the lever inside the cab. On three out of four power reverse engines that we have, I would say the power reverses do not work properly. Possibly every one would go plumb to the corner. But there were cases where you would go to give the engine a couple of notches and they would go to the extreme

forward motion. I will say that happened the last time in the
320 last thirty days. I do not know the number of that engine.

I was running between Fairmont, W.Va., and Keyser. I cannot give you the specific date unless I have my time book, which is at home. On that trip practically every time I would go to let it down, the lever would go to the corner. I reported that engine and I have not had it since. I could not state as to whether it was taken care of. I could not tell you if that was the only time in the last month I had that happen. As I said before, 75 per cent was a fair estimate of the amount that would do that. I have not worked since the 28th or 29th of the month, but for the 30 days preceding that, I would say that I had occasions when the lever went into the corner or crept in that fashion. We have an engine a round trip, and I would have that engine east and have it back, and sometimes they would jump us up on an engine at the other end. I would say in that length of time I have had 12 different engines. I would say I had this trouble of creeping with eight or nine. In this period about which we are talking I reported all of them. I would report

the power reverse examined, creeping very bad. I reported eight times, or a matter like that, if I had that many. That was the month preceding the 29th of May of this year. I reported that at Keyser and Grafton. That was my experience longer than over a year preceding the 29th of May with the power reverse gear acting in that fashion. As to whether during the year I had about that same experience: It ran along just about like that, as well as I can remember, yes; and I reported the power reverse gear creeping each time. As to what engines and the numbers of them that I have been using: That would be hard for me to give you without referring to the time book. They are articulated Mallet type and the num-
321 bers run from 7200 to 7215 and from 7100 to 7170. I cannot just recall the specific numbers of the engines right now, because there are so many of them there. But you can take any numbers you care to out of that bunch, because I am running 7170 today and get the 7150 tomorrow, and I may get the 7123 the next day. I do not keep copies of my work reports. This condition has gone on ever since I have been operating the power reverse gear, ten years or so; they seem to have had trouble all along. I judge 8 or 9 engines out of 12 would be a fair estimate. I imagine I reported them all along, because the rules require us to report these things, and I generally report every defect in detail. We have passenger engines in our territory which are equipped with power reverse gear. I have never operated those engines but have observed other men operating them as I have gone along the road. I guess those engines have a speed of 50 miles an hour on our division. They had better not get up to 60 miles. I would not know whether they were running very fast or whether they were making 40 or 50 miles an hour. I would not be able to state when standing on the ground as they pass me. They are supposed to maintain their schedules. As to whether it is possible for a train equipped with power reverse to maintain the speed that our road requires: You will have to talk to someone in that particular service, because I would not be able to give you any information on that. I never ran the Capitol Limited. It passed me on the road many times. I would judge the speed of that train around 45 or 50 miles an hour in places and at other places down as low as 30 or 35 miles an hour. That is the train that is on time 97 percent of the time, or some such amount. From my experience in running engines I would not think a locomotive could maintain a speed of 50 miles an hour or 60 if the reverse gear is in the corner. You will have to talk to somebody who travels at a speed like that.

322 I would not be able to tell you because I do not experience any speed like that and never have in my railroad experience. I am able to maintain the speed that is required of me in freight service. I always have done it; that is, if the equipment was all right. If it was so I could handle it and control the cut-off it would be all right, but if it was not I could not maintain the schedule. I do not recall having reported to the company on any occasions

that I could not make the time because the power reverse gear put the gear in the corner. The last time I experienced the power reverse gear freezing in cold weather was this winter a year ago. I do not remember what month it was. It might have happened two or three times in a year during the winter months when the mercury was low. I think it happened about twice in the last year or two. The first time it happened in Keyser yard. My locomotive was coupled to the train and had been standing possibly 15 or 20 minutes. When I could not operate the reverse lever and it was zero and below that, then we would naturally suppose that it was frozen up, so we would get out and thaw the cylinder, drain it out, and it would operate then. We would hold oily waste under the cylinder and it would draw the moisture in there and drain it out. Possibly you wouldn't have any more trouble that trip. About this occasion in Keyser yard: As well as I can remember that was the only time it froze up that day (T. 1282–1293).

The other time it happened at Mountain Lake Park, where my engine was taking water. At that time we were standing 15 or 18 minutes. That train contained about 85 empty cars. When I approached that Mountain Lake water stop the lever would be in the forward motion. I imagine I let it clear down into the corner when I stopped. We cut off to take water, and possibly we were stopped two or three carloads back, sometimes not so far. We would pull up to take water. When I would come back to couple the train I would find it frozen up.

323 "Q. When you got back to the train did you find your air cylinders in the air-brake system frozen?

"A. Frozen before I got back to the train. I couldn't get back to the train without reversing the engine, you know.

"By Mr. McLaughlin:

"Q. I am asking you about the air-brake cylinders on that engine, operated with the independent brake valve. Did you find the cylinder there was frozen?

"A. No, sir."

I have had the cylinders frozen. I have had the disturbing valve frozen that would not operate. I have had the train line frozen so that I would have to thaw it out possibly two or three cars back from the locomotive—many occasions. I would not say that the train line or any of the air cylinders of the air-brake system would freeze as often as the power reverse; I don't know. More than likely they might have been properly drained. As to whether the cylinders on the power reverse are drained any differently than the cylinders on the air reverse: Maybe the air will accumulate more to one part than it will to the other. There may be a drip pot on there that would take care of the moisture in the air.

"Q. Don't you know that cylinders of the air-brake mechanism are further away from any heat of the boiler than the air reverse cylinder?

"A. I don't see much difference in them."

The cylinders underneath the cars haven't any heat at all. You will find when you experience any trouble in freezing up it is generally close to the locomotive. I have had the cylinder under the tank freeze up. The brake cylinders do not have a drip pot. I wouldn't say that there would be more of a tendency for them to freeze up than the power reverse. I would not say it would
324 be equally as often that they would freeze as the air cylinder.

I have had the power reverse frozen up more often than I have the brake system. I don't remember as to how many times I had the air brake cylinders freeze. When the air cylinder of the power reverse gear freezes up in this fashion, we have to thaw it out. It requires a little time to do that. We have to possibly get up on the guide and side rods to do that. I inspect my locomotive before I take it out on each trip and I can see all of the parts of the reverse gear and the valve mechanism. You look at those parts so often you can naturally see if anything is out of place as you are walking around and oiling around. That is the only time we get for inspection, when we are getting ready. That is about the only time we have to make the inspection. We have Baker valve gear. I have had no experience with the Stephenson for a long time. I believe there are some on what they call the "snapper" engines. You can practically see all of the parts of the Baker gear when you are looking around, but you would have to get up on the rods to look at the parts of the Stephenson. You can see the adjustment of the counterbalance spring. You cannot tell until you handle the lever. Some have a housing around them. Years ago, I believe I found a case or two where the latch and notches of the quadrant were worn. When I was handling the manual reverse engines that occurred possibly one or twice in my railroad experience. I cannot really say that those are the only times I noticed that the latch was worn on the notches in the quadrant rounded off, but I remember of one of two times when I would find they would be worn; as to how many times, I cannot say positively. I imagine I reported them on those occasions when I found a defect or anything like that. Engineers are supposed to report all of the defects existing when they
325 get in; everything we can possibly remember and think of.

Sometimes I will take a check on a little piece of paper or something if I get an unusually bad engine or if the engine is badly worn, and I would take little notes so that I can cover pretty well the inspection in the report. You cannot see the mechanism of the cylinder of the air reverse when you are making an inspection, neither can you see the mechanism of the steam cylinder. In my experience I have never considered the hand lever unsafe. I would not like to answer the question of whether I still think the hand operated lever is a safe device if other engineers have been injured by the lever pulling down to the corner, because I don't know of any that has been injured with it. I don't say that there have not been,

but I don't know of any. I have been operating the power reverse gear since 1920, about 11 years. That is, I have been in service that had those levers for that length of time. I never had any sort of an accident or injury that occurred due to the power reverse gear. This creeping situation would naturally worry a person if they cannot run this locomotive as it should be run and run it economically, because it would just keep you thinking all of the time, and you are trying to get it set where you want it to maintain the proper cut-off, and it wouldn't do that. The creeping would be going back or coming down. You would naturally worry about that. With the manual lever you can set that lever and it will stay where you put it. For six or seven years at the beginning of my service we were using locomotives equipped entirely with the manual reverse lever. I was in both road and yard service. I would say three years of that time I was on the extra list, which would require me to work in both places.

"Q. When you are running along and you have your engine hooked in the position where you want it, how would the reverse lever act, that is, would it just stand there quietly?

326 "A. That would depend altogether upon the condition of the cylinder or how much lost motion was in your valve gear."

I have found a lever that would start to quiver a little due to the fact that the valves were getting dry. Increase the lubrication to them and it would generally take care of it. By "quivering a little" I mean it would just naturally shake. You could hear it quiver; that would be unusual. As to whether from my experience it was usual for the lever to sit quietly or for it to quiver when I am running along. It has been quite a while ago, and it is pretty hard to come out and bring out my experience of 20 years ago. Some were quiet and some were not, but it was due to something wrong with the locomotive some place. I would not be able to say that three-quarters of the time my lever would be quiet in the notch, because I might have gotten bad engines at different times and a bunch of good ones at times. I cannot state as to that. I don't think I can add anything to what I have already said as to my general experience with the lever, whether it would stand quietly or quiver. I have run locomotives where the reverse lever would be quiet and others would not. The quivering was due to some defect, the locomotive being dry or something. Perhaps not properly equalized. If everything was leaning forward and that spring was not equalized it would naturally try to pull that way. But if it was maintained properly I cannot see any reason why it would not go along all right. I am trying to give you my experience from the best of my knowledge. Nothing resulted from or by reason of the quivering. I do not recall that the latch ever jumped (T. 1293–1305). If I thought the valve was dry I would increase the lubrication to the valve. If I thought it was some other defect I would report it when I got in.

By Mr. STEVENSON:

"Q. Did you ever have occasion to handle the lever, that is, operate it, after you noticed it quivering, Mr. Geldbaugh?

327 "A. Oh, I don't suppose I did until I would stop.

"Q. Would there be any reason why you did not move it until you stopped?

"A. Maybe it would not be necessary.

"Q. If the valves were becoming dry what effect on the lever would that have?

"A. If the lever quivered from the valves becoming dry or if the valves were becoming dry the lever would quiver."

The effect that made it quiver: I do not suppose they were moving as freely over the seat as they should. I would think there would be just a little more friction on the lever from the valve mechanism than there would be if it was lubricated. These valves are away down in front of the reverse lever, on top of the cylinder. But they are also connected with the mechanism. As to what this has to do with the reverse lever away back in the cab: They are all connected together. There is a pull back and forth that results from the valve being dry that causes this reverse lever to shimmy or quiver. The reverse lever controls the flow of steam from your boiler to your cylinder and if the valve becomes dry, naturally there would be a friction there and there would be a little harder pull on the lever than there would be if it were lubricated.

"Q. The reverse lever does not pull the valve, does it?

"A. It is all connected up. The mechanism is all tied together, you see."

If the valve becomes dry, it makes the lever quiver because there is friction down there in the valve. If there is friction in the valve, it makes the lever harder to pull. If the valve gets dry it pulls on the lever. It would take more strength than it did before to work the lever when the valve is dry. Under those conditions with

328 the lever quivering, I don't think I would have undertaken to handle it without bracing myself on the foot brace, because it would work too stiff. It might have pulled out of my hands or if I had hold of it, it might have pulled me over.

"Q. So that when the valves are dry for any reason and the lever must be operated there is an element of danger to the engineering in doing it, isn't there?

"A. Well, not any more than there would be if he were to get in front of the locomotive or something that he can grab when is supposed to not grab it. You know, we don't run the locomotive with them dry very long because you would not get any place with them if you did. It might be for a few miles a valve would get dry but would correct it right away if you have anything to correct it with, which you generally have. Those are rare cases, too. We don't have that, in my experience, any more, because they have a different system of lubrication now on the engines that I am running. We have automatic lubricators on practically all of them."

When we have a dry valve it would take about 12 to 15 minutes, or possibly a little longer, to get lubrication to the valve. We have different ways that we can lubricate them. We used to lubricate them through a vacuum valve. You can release it immediately when you do that. And we had oil cups on top of the valve. You could not do that very well without cutting off the steam. I had switching service with the hand lever. I would take signals from the rear if I was switching in that direction. I have done switching in that direction. When I was getting signals from the rear I would stand up in the cab and just turn my left side to the window instead of the right side. As to how I would handle the reverse lever if I was given a signal from the rear requiring me to reverse my en-
329 gine: I don't suppose I could keep my head out of the window and watch the ground while I did it. I never switched with a power reverse in switching service. From my knowledge of the operation of the power reverse, I could reverse my engine keeping in the position where I am getting signals from the man in the rear. I have done the same with the manual reverse. I have done this in making a switch on the train. I never run an engine with power reverse. It was all manual. But I have made switches to throw a car out, and they grab the lever and throw it back and look back to get the signal. When they grab the air brake handle they apply the air. Maybe they will give a signal to go ahead, and I look around to see, and can get hold of the handle. I know men who do it on locomotives today. In handling the manual lever any freezing weather has a tendency to freeze the lubrication, and it would all get off the links and the dies and different parts. We have zero weather in our country, also quite a lot of snow, sleet, etc. I have noticed snow and ice when I would go to oil around, the lubrication would be off of them, but I have never had one frozen up that I could not handle it. I have never experienced any difficulty in cold weather in handling the power reverse.

"Q. I am speaking of hand reverse.

"A. I mean hand reverse.

"Q. It would not make any difference?

"A. I can't see much difference in them. You can take the guide on the locomotive running along in the snow, and lots of time if the weather is real cold it will slip along over that ice and the two metals will not even cut."

I cannot say as to whether or not it was any more difficult to handle the manual lever in zero weather than in summer weather. I operated both of them in summer and winter.

330 By Mr. McDONALD:

"Q. In your testimony this morning you said, as I understood, that certain men on the division you work on were in the yard service where there were engines with manual reverse gear rather than take road engines with power reverse. I don't know that that

is just what you meant, but I would like to find out. Did you mean that was the only reason those men went into the yard service—because they did not want to use the power reverse?

"A. No; I don't think that was the reason. They took the turn as a choice or preference."

There might have been many reasons aside from the reverse gear for their going into that service. I have been on the railway something like 25 or 30 years; there might be cases where men take yard engines because of sickness at home so that they can be home. I wouldn't say there were not. Those locomotives I was running with the manual reverse gear had slide valves. I have had some with the piston valves. I have experienced trouble due to leaky valve rings or strips. That would cause a reverse leverse to jerk (T. 1305–1316).

I believe I have had something like that happen. In operating a locomotive with hand reverse gear it would cause a greater pull on the reverse lever if there were steam in the valve chambers. I have had trouble in reversing an engine when there was steam in the cylinders; there would be quite a pull on it. The cylinder cocks failing to operate, or a leaky throttle, could cause that condition. It would make considerable strain on the reverse gear when you came to reversing it. I frequently spotted a string of 25 or 30 cars without having to reverse my engine in yard service, by stopping with the independent brake valve. I wouldn't be able to say how much slack there would be in 25 cars, possibly six or something like that. I don't think in 25 cars there would be pretty nearly 20 feet of
331 slack. We have standard brake and drawbar equipment on our railroad. I can spot, and have spotted, 25 cars without reversing the engine. When you apply the brake the cars close in against the locomotive. I have seen this power reverse gear, when the engine was standing in the roundhouse and the pump shut off for some reason, or standing anywhere with the pump shut off, work down to the center of the quadrant, forward or back, and then when the pump was started, the machinery would come to the place where you had the reverse lever set. When the engine is standing the reverse lever is not in the center in all cases, but I imagine it generally is. As to the harm it would do if it was on center when you were stopped and were standing in the roundhouse and the pump shut off and it worked down to the corner and then the pump was started and it came back to the center: If you might happen to have your hand in some particular place where a rod or two was too close together, it might have a tendency to catch it. It would creep back to the center; a block comes up in the link. I couldn't say as to whether it would do any harm aside from that if you happen to let your hand get in, it would catch it. It is absolutely a fact that the engine would be in a much safer condition with the reverse lever in the center. I cannot say as to what harm might happen from that defect.

There might be a possibility of a man who might be working there of getting caught some place by the moving of the radius rod, which also moves when the block moves. It could also happen in case there was any leaking steam in the locomotive from the steam accumulating in the cylinders, and you have the locomotive moving in one direction or the other, after that gear dropped down, even though
332 the power reverse operating lever was on center and all of the air was pumped up. As to whether, taking into consideration those things, I think the power reverse gear is as safe as the hand reverse gear in handling locomotive around the terminal, with regard to the pumps being shut off and the air going off the engine: I don't think it is. The air would naturally leak off the engine when they closed the pumps down. By "considerable strain" on the reverse gear, with steam in the cylinder, I mean it would be harder to handle. It would require more effort when reversing the engine with steam in the cylinder than if there wasn't steam in cylinder, but it would not require enough effort to work any hardship on me under those circumstances. It may only happen once in a trip. I cannot recall in my experience ever having any particular difficulty in handling a locomotive equipped with hand lever in the winter time due to the extreme cold weather. I would not say that I could reverse the hand lever engine without pulling my head back into the cab; ordinarily you would have to be in the cab to reverse the engine. You can reverse the power reverse gear equipped engine without pulling your head back into the cab, but you would have to look where you are putting your hand to get hold of the lever. I observed that on a certain locomotive these other men at the present time in switching can reverse their engines with the hand lever without bringing their heads inside of the cab.

By Examiner ROGERS:

"Q. Is that usual or unusual that they can do that?

"A. Well, I would not just be able to say.

"Q. Can they do that as much of the time as they cannot do it?

"A. I would imagine they could, yes, sir. I will say that they could."

I don't recall having any experience where when the valves were dry and I was handling the lever at a certain speed it would pull away from me and would pull me into the corner.

333 By Mr. MOREHOUSE:

"Q. I will withdraw that question and try another one, then. You were asked on cross-examination if you had not had some experience when the valves got dry and the hand lever handled stiffer than it did ordinarily, and you were asked whether or not in your judgment there was any danger. I would like to ask you if you yourself have had occasion to handle a hand lever when the valves were dry under circumstances when you experience any danger to yourself?

"A. No, sir" (T. 1316–1326).

As to whether the lever of the power reverse gear, in my experience, has quivered or given any indication of dry valves or other defective parts such as I stated were indicated when the hand lever quivered: I wouldn't have any way to know by the reverse lever in the cab. I would not say that my hand lever would give me a better indication of the running condition of my valve parts, the valve and valve gear, than the power reverse lever does. I would not like to say as to whether that is a proper indicator, but the fact remains that it is an indicator that there is something wrong when they get unusually rough or when they begin to shimmy or quiver, as we call it. These work reports with respect to the creeping gears were written, and there were times when I have told the roundhouse foreman about it, too, in addition to the work report; and sometimes maybe I would overlook the report, and I have called them on the phone and told them about certain defects and there may have been power reverse in there for all I remember. But I know I have called them up because I would think of something that happened on the trip I had forgotten, and I would call them up and tell them about it.

"Q. Referring to the condition where you might have the power reverse gear cylinder and apparatus frozen up, and, as suggested to you by counsel, that your brake reservoir or your air reservoir for the independent brake valve should be frozen at the same time;
334 would you then have any control over your locomotives, or to what extent would you have control over your locomotive when equipped with the power reverse gear?

"A. They would both be inoperative."

I would not be able to reverse the locomotive. If the brake was frozen up I would not be able to apply it. If I had a hand lever and was running forward I could reverse the engine and give the engine some steam to stop. You can reverse an engine either when they are running or standing. In switching movement when you get a signal to reverse you do not bring the engine to a stop in all cases before you reverse the engine. If you are down to a low speed you can reverse her. You apply the air first. It has been frequent that we have had engines which were not properly equalized.

T. W. Pugh, locomotive engineer for the B. & O. R.R., living at Cumberland, Md., and 60 years old, testified:

I have had no experience with other railroads. I was employed by the B. & O. in 1887, and was promoted to run a locomotive in 1896. Prior to that time I worked in the shop as machinist helper and boilermaker helper until 1891, when I went to firing. I have been in service practically all of the time since 1896 as a locomotive engineer. At the present time I run between Cumberland, Md., and Grafton, W.Va. All of my experience has been on that same division. I am now running through passenger one way and local the other. I have had most of my experience in through freight, except passenger. I was on the extra list for a while. I would have

some experience in all, but not so much. I have had some yard experience in switching, but it was slim. It was in my early running, possibly in the 90's. I have had experience with engines equipped with the power-reverse gear since they came there. We have had a few power-reverse gears since 1914, 1915, or 1916, or along in there. I don't know just when it was. Since that time my experience has been considerably more with the manually operated than with the power
335 reverse. I have operated power reverse. I think I had one regular engine with it, the 5063. But other than that I never had a regular engine with power reverse. I have had them off and on in just mixed service as I would get them on the runs. The greater portion of my time has been with the manual, either a screw or a bar. We still get engines equipped with the manual, screw, bar, and power reverse. As to the different kinds and makes of the gears which I have operated on these locomotives that are equipped with the power-reverse gear: The most of it, the one I had regular, was the Ragonett, and I have had some experience with the Barco and Alco. The range of the weights in pounds on drivers of the engines that I had with the power reverse would be between about 150,000 and 200,000 pounds, and some smaller. The weights of engines that I have operated with the manual type of reverse gear are very much the same. The same engines in fact, with a different reverse on them. That is in recent years since I have gotten the power reverse. Prior to that time, I judge 140,000 pounds was the weights of engines I had experience with on the hand reverse when I was using that exclusively. I think the engines would have weighed about 75 or 80 tons, and from that on up to the engines that I now have. I have never suffered any injury due to the handling or operation of the manually operated reverse gear nor any injury due to the operating of the power-reverse gear. As to whether I have had any experience in the operation of the lever type of hand gear of the lever jumping out of the quadrant, that is, becoming unlatched without my unlatching it and going to the front corner: I have had things of that kind to happen with the old slide valve. That occurrence was not very frequent, not often. I couldn't say as to the last time I had that occurrence with the hand operated gear. It has been fifteen years since I ran that class of engines. The engines I handle are
336 piston valves principally now and that slide valve arrangement is not there (T. 1326–1336).

"Q. Then do I understand you have not had that occurrence with the piston-valve engines?

"A. No, sir; I don't remember that, unless, I would add to that; there was some defect or bolt loose in the dog or something wrong with the keeper or dirt in the notch. Something of that kind might happen on the road that I would correct myself—clean out the dirt or tighten the dog."

As to whether I recall any instances of that happening within the last 15 years, I cannot give an specific instance, although it has happened frequently—that is, a little thing of that kind that I

could correct myself. On occasions of that kind if I wasn't going to do anything with the lever it would go down into the corner. The weight of the motion gear would take it forward. The lever never struck me or injured me in any way under those circumstances. The lever would just usually go down with a jerk under those circumstances. On those occasions as a rule I could always rectify the condition which caused that while on the road. It was some little thing, just out of shop, but not always, maybe. I don't recall that I ever had the experience of the hand lever pulling away from me after I unlatched it. Some of the manually operated types of reverse gear handle harder than others. I was always able to handle them right decently. I never knew much else. I mean I handled them more than the others, and I was brought up with them and I handled them more than the other reverse or the other power. I have never overstrained or overtaxed myself in any way in operating or trying to operate either of the manually operated types of hand-reverse gear. As to my experience with the manually operated types of gear, as to my ability to maintain a given point of cut-off
337 on the locomotive in running over the road, it would always stay where I put it—stationary. My experience in that respect with the power-reverse gear that I have operated has not been as good. It would move and not hold the valve where I wanted it to be.

"Q. Is that limited to any one of the classes or types of gears that you named, or does it include all three of them?

"A. I don't think I ever had any that stayed to their place altogether. I don't remember that I did."

That tendency of their not staying in their places would have some effect on me but it would throw the valve out and make the engine lame. She would work back a little bit and not be doing the work properly and not hauling the train well, and then possibly she would go too far the other way. When I found a condition of that kind I would move the bar. If she would go back I would move it ahead a little bit and try to divide it up the best I could. As to the extent that made it necessary for me to handle the operating lever of the power reverse gear—sometimes a very little bit. If I moved the lever possibly a notch the valve would go then further than I would want in forward motion. At other times I could not do anything other than just manipulate that lever to try to get it. As to whether it was ever necessary for me to throw it to the corner in order to straighten it out, it would go there itself without putting the bar clear there. I don't think I ever had to throw the lever over on account of an engine creeping. If she was back too far and if I would put her back a little bit she could go over of her own accord. The valve motion itself crept both ways. It would be just enough to knock a valve out. It would not control the cut-off of the valve. I have had the experience of it creeping when the engine was hooked up pretty close to the center; just about the same operation. As to whether I ever had the experience of

338 it creeping back to the center or past the center, I think I have had them to cut out so that I would have to set them down a little bit.

"Q. When you have an engine of that kind or when you have an engine that is acting in that way, that is, with the creeping gear, what is the fact as to whether or not it is necessary to give more attention to your operating lever than in the case of an engine equipped with the manual type of gear?

"A. Well, it takes more attention if it is working badly."

My experience as to the comparative length of time in operating the hand reverse lever and the engine equipped with the power reverse gear has been very much the same. I do not recall having any other experience with the power reverse gear acting in any other way than this action which I have described and designated as creeping. In runninng over the road I don't think I have at any time observed the movement of the valve gear and the cross head next to the power reverse gear air chamber. I would have to have my head out, and whether I could see it then or not, I doubt it. I never had any difficulty with respect to the screw type of manually operated hand gear. I have had some that would not stay latched because of a worn latch that possibly would not stay latched. I have had them so that they would not stay latched until you got to the top. In a case of that kind I would just pull her back where I wanted her and put a monkey-wrench on it. When this screw type unlatches, it will go to the forward motion sometime when you are running, the same as it will on the other type. The wheel spins, I have seen it spin. It just depends upon how fast it will go down. Sometimes it will go very slow, and sometimes faster. But I have never had any to spin any ways fast. They go very slow sometimes. The wheel must turn for the gear to go. I never experienced any injury in connection with anything of that kind. Those wheels
339 that operate the screw gear are located directly in front of the engineer's seat; it would be eight inches in front of his knees sitting on the box. As to the clearance on the locomotives I have operated, that is, the room that the engineer has sitting in his seat in the cab: I have always had plenty of room. My weight is 205 pounds. From the standpoint of economy of operation and efficiency of operation of the locomotive, I have always found that the hand-operated engines stayed put where I wanted her very much better than the power reverse. If an engine works evenly and smoothly and the valves are not out they will burn less coal and use less water. I found that I could not run my engine in that smooth way as much of the time with the power reverse gear as with the hand-operated gear. As to whether in operating the bar type of hand gear I ordinarily get up from my seat in order to reverse the engine. It depends upon how hard she handles. I have gotten up to do it. But as a rule an engine that is working properly I can reverse her sitting on the seat. By reversing the engine I mean the throwing of the lever from one extreme to the other. I do that

sitting on my seat. I do not tell you I have always done that, because I have had engines that I could not do it with easily. I inspect my engine before I take it out. With the manual type of gears I am able to determine before I go out whether there is any defect in connection with the lever or the wheel or the notches in the quadrant, the most of the gear is visible. If I would not overlook it I ought to see it. You cannot tell with the power reverse gear before you start out how it is going to act, not until you try it. You could inspect the outside parts, etc.; the bolts, etc. You might look at it. But I cannot tell until it is in operation whether it is going to work properly or not. As to what extent I have been able to keep a look-
out and observe signals, both fixed signals and signals from
340 trainmen while operating an engine equipped with the hand
type of reverse gear. I do not feel that the two operations conflict very much. If you come to a looking out place for a signal, it is not necessary to change gears; it is only a secondary matter anyway to drop a bar down a little bit or change it, if necessary. I would not consider that the doing of it interferes in any way with your keeping a look-out. I have never experienced anything unsafe about the hand types of reverse gears that I have operated.

By Mr. MOREHOUSE:

"Q. What is your opinion, Mr. Pugh, as to the comparative safety of the two types of gear? And by that I mean the hand or manually operated type as compared with the power reverse type of gear?

"A. I do not see anything hazardous about it except the workings of the gear. There is no danger about it."

I mean it does not do the job or stay where I want it, that is, stay where the other one does (T. 1336–1346).

There is nothing unsafe about either one of them—in operation. I don't recall that I ever observed the moving of these gear parts—the valve main parts—while the engine is at the terminal, except that I have seen when I would possibly be on the ground and the engine standing and maybe I would go to her. She has no reverse until the air is pumped up, that is, the power reverse. And I have gone to the engine when they would turn the air pump on and when the pressure would come up you could see the motion of your lift. I have noticed that—I would not say how many times—any time that I would be standing around. You can walk down there now and take an engine that has no air with power reverse and put the pump on, and when the pump goes on you will see the gear come to where the reverse lever sets, or something near it. That cannot happen with an engine equipped with the manual type of gear. You can move a manual type of engine, move her ahead and
back and stop it as you please. But if you start a power re-
341 verse without air you only have a sled or something else; you
have nothing to stop her with it. I think I can move the engine where I please with the manual and stop it or start it with the reverse bar without using the brakes. As to whether I consider

that that has any bearing upon the relative safety of the two types of gears: If an engine is standing at the road track and a man would get up there to start to move her without air, he has started something he can't stop.

CROSS-EXAMINATION

A dry valve would make a motion gear rough; it would make it restless. It does not have a tendency to lift the bar out of the quadrant; I don't think it would change the notch in the bar. I wouldn't think that. When they vibrate there would be a tendency of the valve motion to pull the lever forward if the engine is going in forward motion; the bar is holding the motion gear up to that position. If you disengage the latch and you have dry valves and attempt to lower the lever toward the corner you find a pull. If I would knock the dog loose or the latch it would go the way the engine is going. I would have no occasion to let down the engine on a passenger train going 50 or 60 miles an hour. I don't let it down at high speed. You want it back for high speed. Pulling it back at high speed and with dry valves you find that same pull against as you attempt to hook her back towards the center; you must bring it back. You brace yourself on the quadrant with your foot very often to be able to just take a secure hold of the bar to bring it up. If you did not brace yourself in that way there would be a very weak tendency lots of times of the lever to pull out of your hands, and other times it would be strong; I have had them when it would be. I do not have occasion to change gears when an engine is running at
342 high speed. By "high speed" I mean 40 or 50 miles an hour. We are allowed 45 miles an hour. That is our limit. If an engine is going that fast you just want her to go; that is all. As a rule, we set our bars in pulling away from the station and she will be down in full stroke and we will put it back a notch or two at a time to get her back into working position, and let her go. The last time you hook her up you are possibly running 30 miles an hour in passenger service. The pull is there all of the time. When you are moving the pull is always there. The tendency is for the bar to go ahead when you are going ahead. In this experience I just told you I have that pull under circumstances when the gear is in relatively good shape, but less; not much of it. When there are difficulties in the gear then the pull is greater. As to whether one of those difficulties is lack of lubrication in the valve: I have not had so much experience. I have had dry valves; I will admit that, but it is not a daily occurrence. It just might happen sometimes, but not often. When it does happen it is a worse condition than when properly lubricated.

"Q. And when you have lost motion in the reversing gear and the tumbling shaft boxes and the links, then you have another condition with which to contend in the lever being unstable; isn't that right?

"A. Well, it has always stayed where I wanted it."

The lever might tremble when you have lost motion in these different parts, yet it stays right in that notch. I never have the prac-

tice of putting my hand on the lever to stabilize the trembling, or putting a nut or anything of the sort in there to hold it in place; I don't see that the trembling would bother me at all. When the latch mechanism is weak and the latch points or the quadrant notches are worn, I have had the lever to slip out of the quadrant and
343 slide down a notch or two. I have had them go all of the way down, but not very often. We do not always get good trips. We sometimes get a bad one. There are times when if I wanted the lever back I would pull it back. If I wanted it back I do it and ease the throttle off and take hold of the bar and take it back where I wanted it. There are lots of places where it might occur where I would let it stay right where it was. When it goes down under those circumstances sometimes it goes down with a bang and sometimes it does not. But with an open throttle the bar would be more likely to go. When it goes with a bang I would not go after the lever at all; I would just let it go. There is no fear that in pulling it back it might give some jerk. I don't know anything about any force behind it. I wouldn't have hold of it. The force was pulling at that fast. The force is in front. The weight of the valve gear itself has a natural tendency to pull the bar ahead if it is not secure. I have had experience with broken valve rings or strips and my guide valve breaking or fouling. That makes an engine work very hard if a spring breaks under a valve strip or a pressure plate becomes loose. It makes the engine work harder. It binds down. In other words, it gets steam on top of the valve, where it should not be, and it makes it work hard.

"Q. And if you had that happen out on a run and had to handle the lever it would be a dangerous thing, would it not?

"A. I never had any. I always just came on home with it. It never injured me."

As to whether I consider it a dangerous operation to have to handle the lever when the valve ring is broken or the steam is riding on top of the valve: It might be rough enough to break something else, but I never had it injure me at all. There could be a possibility with the throttle open that the lever will give a
344 jerk while you are handling it and throw off balance and injure you. But if I wanted to handle it I would ease the pressure off with the throttle so it would not be severe, not in fear, but to make it so that I can handle it more easily.

Shifting the hand lever does not overcome creeping of the power reverse lever; it will take it out of the position that the engine will not do business, but you may put it in the extreme the other way, just as bad. Sometimes the engine will correct itself and it will come right back to where it started from.

"Q. And even on the occasions where you say you have had experience of the power reverse lever cutting out you can adjust that by simply moving the power reverse lever?

"A. I can try to adjust it, but as a rule I can't. I can put it some place else, but it will not stay where I put it."

I have operated occasionally some power reverse levers which operated all right, but I never had but one regular; and the truth of the matter is it annoyed me as long as I had it (T. 1346–1356).

It was a 4–6–2, passenger engine, with Ragonett power reverse. That was 9 or 10 years ago. I think they still have the same reverse lever on that engine. I think the same reverse lever is on the 5063 now. I don't know whether they have been able to overcome that. She has gone from me seven or eight years ago. As to whether I know at the present time if they have corrected that or not: I see the engine there. She is on the Connellsville division in helping service. I see the engine, but I have not run her for a considerable time. I have reported this difficulty of creeping. I am in the habit of reporting any defect I find. When I report it, the shop forces have overcome it for a short time and it would be right back to its old tricks. When I report it they would correct it. If I have a power reverse engine which is holding the cut-off about where I want
345 it I am able to keep an adjustment, if it performs the work the way it should. As to whether I can keep really a finer adjustment with the power reverse than I can with the hand operated reverse: I don't see it. The hand operated reverse, in my opinion, stays where you put it. It is a stationary affair, and when it is notched there your valves have the same travel and will keep that travel while the bar is there. The notches in the quadrant of my hand-operated reverse are a half inch or three-quarters apart; on the power reverse they are very small, like a saw blade. As to whether I can make a much finer adjustment on the lever on the power reverse than I can by using these half or three-quarter inch notches on the quadrant: A locomotive is a crude affair; it is not like an automobile. You do not need to go to an eighth of an inch on a quadrant. You can't notice the effect that it has on it when you do it on a power reverse. As to whether I ever had the experience of wanting to hook up a manually operated engine just a little more between notches so that if I had an extra notch in there I would have used it: There are plenty of notches in there. I can pull it back another inch any time. I do not know how many notches there are in the ordinary hand reverse quadrant. I don't know how the number of notches in the hand reverse quadrant compares with the number of notches on the power reverse quadrant, except the hand reverse quadrant is possibly three feet long and the power reverse quadrant is possibly 16 or 18 inches, and that is the reason the notches are so much smaller. I don't think the hand operated have as many notches as that little saw blade. On this occasion when I observed an engine standing and when the air pressure comes on I have seen the motion working a bit that would be in the link block; just to pull the motion gear up to the position the lever was setting in. I have never seen an engine move when the air came on and the link motion moved. The engine is propelled by steam, and that is air that you are getting then. It takes steam in the cylinder on the
346 engine to move it. I have never observed any such movement.

Air does not do it. I have never observed anyone being hurt by the movement of those link blocks. I don't remember any power reverse gears that did not creep; all that I have operated crept. I have not operated all of them, but I have operated three types, the Ragonett, Barco, and Alco. I couldn't tell you whether a Barco will creep or not. I have handled the reverses that I didn't know the differences in which ones they were, except the old original one, the only one I ever had regular. But I am sure with the engines I have run I have had some of them. I would not say particularly that it would. I have made trips on power reverse when they did not creep, but I would not try to distinguish to you which one it was. All that I ran would creep at times. Now, I might have had hold of a type that did not creep. I would not say that the Barco power reverse crept with me of late, for I am not familiar enough with it and haven't used it enough to be familiar with it. I know either the Alco or the Barco creeps. I know I have had creeping other than on the Ragonett. I have not had occasion to operate the Franklin Precision, the screw power reverse. I have reported this creeping on my work reports, but couldn't give you a date as to when I made the last report. It has been several years since I ran the 5063. My last experience with those power reverses—the engines are running through. They go from Washington to Wheeling and Grafton, and I will come home to my terminal and just step off there and somebody will bring her on this way, without going to the shop at all or making any report. As to this thing of my knowledge when I last reported a creeping power reverse: I could not just give you dates, because I have run the screw reverse, and regular, until they got to running the engines through, and now I pick up a power reverse occasionally coming through, and I don't get her at the shop and I don't take her to the shop. I don't make reports after any defect
347 on my locomotive; not on those occasions. I will go to the station and step on the engine that a man runs from here to Cumberland, and take her to Grafton, and sometimes bring her back, and she comes right back here again. When I get to Grafton that is the end of my run. If there is anything wrong with the engine, such as a creeping valve, I make a report. I did not say that I always have trouble with the power reverse creeping. I have made successful trips on engines on which the power reverse gear did not creep. I often have them to creep—more often than not. I don't know how often I have had a power reverse this year. I have had a power reverse this month. The last engine I ran, the 5046, had a power reverse. I ran her to Cumberland and she came on this way. It operated right decently; did not creep to amount to anything. I didn't make any report on the engine at all. I came right on through. I think I had some power reverse engines in the month of May (T. 1356–1366).

I don't know whether I reported any power reverse creeping during the month of May. If the creeping of the power reverse interfered with the operation of my engine I would report it. I

don't know if I have a power reverse creep sufficiently in the month of May so as to interfere with the operation of my engine and thus require me to report it. I don't know if I reported a creeping-power reverse lever in the month of April. I know that I have reported a creeping reverse gear sometimes. I have gone to the foreman and asked him and explained it to them and have done different things. I can't specify any day, date, or any particular as to when I reported a gear creeping. Whatever creeping there has been has not interfered with my operation of the locomotive. I could handle the engine but it was not as satisfactory as if they would not do that.

I have always gotten in with whatever they called me for.
348 I said the power-reverse gear lever stays right where you put it. The air varies in the piston. I don't know how often that would happen on a trip. It happens more often going up the mountains when you are working the engine hard when you will notice the valve vary and shorten the stroke and lengthen again. It does not take much effort to try to put it back at the point of cut-off you want. It sometimes adjusts itself; and sometimes it will go beyond it, the same as it will come back past it. It is a lot of trouble and annoyance to the engineman. I have had engines going up the mountains that you could notice your speed slowing down with it. And then when you could put the engine down a little further it would burst out and want to do too much. I don't know how often that would happen during the trip, but those things operate that way. It is just whenever they want to. There could be danger of a piece of a broken valve strip or broken valve ring getting into the ports ahead or behind the valve and the reverse lever jerking. That could happen and possibly break something about the hand gearing. As to whether if I had hold of it there would be danger to me: I suppose it would take it out of my hand; I never had it throw me with it.

REDIRECT EXAMINATION

Those conditions of making the lever more difficult to handle when the pressure plate was loose or the spring out of adjustment or valve strip broken, all refer to the old slide valves. It has been 12 or 15 years since I have operated that type of valve. There are not any of them in use on the B. & O. in my territory now, unless it would be in the yard. They might have some there; I don't know. If I had an engine not lubricated I would try to give it a little more oil. That would be as much as I could do for it; just to get the engine lubricated. I have always been able to lubri-
349 cate the engine if there was nothing particularly wrong. In handling it makes the engine handle harder. That is, when they are dry. You can ease the throttle off, get the steam out of the cylinder, and then handle it anyway. In my experience putting the throttle and the lever down has had effect in increasing the lubrication with the hydrostatic lubricator. It lets the oil go down

when you let the pressure out of the valve. I have done that many times in order to increase the lubrication in the valve. As to how long it takes to overcome the dryness of the valves in that way: That depends upon how you are using the engine. If it is up the mountain you cannot do very much with it until you get to the top. As soon as you get to the top and commence coasting a little bit, then you can correct it. On level track it is the same thing exactly. It takes a few minutes to do it. That oil has a good long ways to go.

"Q. Are you speaking now of when you let the lever down and ease off the throttle or just adjusting the lubricator?

"A. Adjusting the lubricator will do it. It takes long, is all.

"Q. How recently can you recall having the hand lever go down in the corner?

"A. Not lately."

As to whether I notice any difference in the way levers are maintained now as against the conditions in the early period of my experience in running engines: The screw reverse has a different keeper on it, but I think the others are very much the same keeper that they have always had—just an ordinary dog. I don't remember that I had any hand reverse engines in the last several years where I had this regular screw type engine.

"Q. These power reverse gear engines that you get occasionally now, you say——

"A. Yes, sir; and that has just been real recently, since they commenced to go through."

350 Some of these power reverse gear engines cut out at Grafton and some do not. They cut out at Grafton from Washington but the ones that come from Cumberland go on past Grafton.

"Q. You spoke of the adjustment of the power reverse gear when it is creeping and moving it and endeavoring to correct it, and it will burst out suddenly. Just what do you mean in that respect?

"A. I mean the engines went down to a further stroke than I wanted it to do."

That had the effect of dragging the train harder; possibly jerking it some. As to whether I know of any complaint with respect to rough handling of trains as a result of that: I get rough handling of trains often. I don't know that that causes it. I don't make any work reports on the engines that I get at Cumberland that go through to Washington or that I leave at Cumberland that come through to Washington. In the case of any defect I would tell the engineer who relieves me. I have on several occasions told him of things. And sometimes the road foreman will ride the engines and hand me a slip of work he has checked over, and I will hand it to the engineer who is going on in. I do not do that at both ends of my division, just at the Cumberland end coming east.

Dragging valve strips, valve springs or breakage of that kind getting into the mechanism and causing the jerk could happen to

any kind of an engine. It could happen with the piston valve engine the same as with the slide valve engine.

"Q. I think your testimony shows that.

"A. I would not mean it that way. The other has rings the same, and they have ports the same."

Out of Cumberland the passenger engines have the screw gear and the helpers. I might just confine it to the Mikado class. The Mallet engines have the power reverse, but the Mikado class have the screw, or most of them. Principally all of my engines are of the Mikado class. I couldn't really say how many Mikados
351 there are on the division on which I am working (T. 1366-1378).

I suppose there are 25 or 30 in helper service and passenger service. That would be about half of the whole number of engines on the division. There is no valve strip on the piston type of valve, pressure plate, nor rings.

JUNIOR B. FRALEY, locomotive fireman for the B. & O. R.R., residing at Rowlesburg, W.Va., and 46 years old, testified:

I have been employed by the B. & O. since April 23, 1910; have been promoted to engineer. I suppose I have had not more than a year and a half's experience running. As to whether I had any experience running engines outside of that year and a half: After I was promoted I fired seven years for J. H. L. Pugh, and I had considerable experience with him. I expect I ran the engine as much as he did; that is, I suppose it was a courtesy to me that he would let me handle the engine lots of times. At present I have fired about six years for Roy Fraley who is related to me. During my experience I have operated engines equipped with the so-called Johnson bar type of hand reverse lever; I have also operated a few equipped with the screw type of hand reverse lever. I have handled engines equipped with power reverse gear from the first ones that came out, which was in 1911 or 1912. I happened to be on a helper job and we got the first ones that came out and we have had them ever since. That was the 2400's, the Mallet. Since that time I have had service on other types. I would say 75 percent of it was on Mallet engines. That was in helping service, from Rowlesburg to Terra Alta and Rowlesburg to Blaser. The distance from Rowlesburg to Terra Alta is 12 miles, and from Rowlesburg to Blaser 6 miles. The other 25 percent of my time since the Mallet engine came out has been with 4400's, that is, the Mikado, and 2700's, 2800's, 1800's. The approximate weights of those engines on drivers run from about 110,000 to 271,000 pounds. As to what types of engines they are: The snapper is the slide valve. I couldn't tell you the wheel
352 arrangement on the snapper. I don't pay enough attention to that as a fireman to look at it. They have not all been in freight service. I had one of these special engines, a snapper engine, on a passenger train for about a year, that is helping passengers and assisting passengers, from Rowlesburg to Terra Alta. We call the

snapper type of engine turtle backs. What we call a snapper is not a switch engine; that was an engine with the cab up on the top of the boiler and the fireman was back, and there wasn't any deck.

"Q. What you call a camel-back?

"A. We have called them turtle backs. That is all I know about them. A double-deck engine."

This so-called snapper type of engine are equipped with manual reverse gear, bar type. They weigh on drivers 166,300 (pounds). The 2700's and 2800's were equipped with manual reverse and the Mallets were equipped with power reverse. I have never been injured or seen anyone injured with the manually operated reverse gear. I have never had the hand lever unlatch and go down to the corner, the front end of the quadrant. I have never worked on a regular passenger run; only in helping service. On that engine I had the Manuel, bar type. As to whether I used one or two hands to handle it: On this particular engine I could place it any place I wanted to with one hand. That is only on one occasion that I remember of. I mean this was the only occasion I ever had I could not move this bar with one hand. I was fooling with the bar and setting it up where I wanted it and the engineer was watching me, and I was showing him how nice she was working, and I held to her a little too long, and set her a little too far once, and she went down into the corner. That wasn't a case of the bar getting unlatched by herself; I had the bar in my hand. That was not the only time I ever had the lever get away with me and go the corner. I have had the Mellin power reverse gear lever get out of the quadrant and go to the corner with me. As to what kind of a gear it is,
353 or what sort of an arrangement: That was with the long bar and it had two bars—a small bar and a big bar. The big bar operated the valve and the small bar operated the air cylinder, reversing the cylinder. At the time I was injured I was handling the engine and we were crossing over from the eastbound main track to the westbound track to run back to Rowlesburg. When I got down and crossed over I knocked the latch out of the bar and when I did that it flew right into the corner. It flew right down against the boiler head. That is this big bar. And in going down there it wrenched me in some way or gave me a jerk of some kind, and I couldn't reverse her. When I knocked the latch out, I intended to move it to bring the engine back west. I was going east and I had crossed over and was coming back. When I went to reverse her, in place of pulling her back it went forward. The engine was standing still at that time. The bar moved forward with greater force than when I would want to be in front of it. I was not standing in front of it but I had hold of it. As to what effect that had upon me physically: It wrenched my back and shoulder. I could not reverse the engine then. I could not have done it at all until the engineer came and did it himself. I was handling the engine for the engineer. As a result of that, I was off from the 13th to the

22nd of September. I was endeavoring to handle that bar and reverse the engine in the ordinary and customary way in which I had handled it before, cautiously, because I knew what she would do, or thought I did. I didn't that time. I have had all kinds of experience with that type of power reverse gear. I think everybody who ran them had the same experience. This particular engine was no worse than any of the balance of them, so far as that is concerned, and she had a bad reputation about the bar, and we would put the grate bar shaker in there. We put her down in the corner where we wanted it and then got the grate bar shaker and put in between the stoker pipe (T. 1378–1389).

354 I have also operated the Ragonett and the Mellin power reverse gears. I am not sure, but I don't think I have ever handled the Alco gear.

"Q. I call your attention to a work train trip that you made one time. Do you recall whether or not that was equipped with an Alco gear?

"A. Yes, sir. But that was a 4400. I don't know what it was equipped with. It was equipped with power reverse but I don't remember whether it was Alco or Ragonett.

"Q. But you know that it was one or the other of them?

"A. Yes; I am positive of that."

I mean by that that some of those engines have one type and some of them have the other. On this occasion of which I speak we were standing in the side track at Tunneltown, W.Va., loading dirt, and in loading dirt the coal had spilled in the ditch along the track, and they gave me a signal to move and I could not move, so I tried to work the bar, and I could not get the engine reversed. And I had trouble with the old bars freezing up. I had a young runner, and the thought struck me that perhaps the bar was frozen up, and I took my oil and waste and got down and went around and heated up the reversing cylinder and walked up into the cab and reversed the engine. When I say the bar was frozen up I mean the reversing air cylinder that operates the bar. I had experience of that kind quite frequently with the old bar with the Mellin gear. As to this bar on the work train that I speak of, I mean the operating lever. It is the operating lever that operates the air valve in the air reversing cylinder. We had that experience of the bar freezing up on the older type of gear practically every trip and every time you stopped in zero weather or colder, or perhaps not quite zero. That was in this helper service with the Mallets that I had that experience. In that vicinity we have zero weather or lower in the winter time

355 quite frequently. It is in the mountainous country. I have had experience with the Barco reverse gear. I never had the experience of being the real engineer on one of them, but I was filling the engineer's position on one the time when the bar flew out of the rack and knocked the right front low-pressure cylinder head out. I had the Mallet locomotive and was running backwards, in backward motion; just where this happened it was just entering

the level, but I don't think we had quite hit the flat yet when this happened. We had come down a hill. Just prior to the accident there was a crossing there and I had blown the whistle for the crossing, and I was sitting on back facing the tank and the bar was to my back. It was one of those small bars. I heard a crack like a cannon, and I couldn't imagine what had happened, and directly the engineer stopped. I began to investigate why she stopped, and I looked around, and the bar was in the forward motion. Of course, I reached up and pulled her open, and when I did that I saw the steam flying out of the cylinder, and I knew there was something wrong. As I was riding there and before I heard this crack like a cannon, I had the bar in the backward motion and was moving with my engine backing up. After I had turned around I noticed that the bar was in the forward position, in other words, at the opposite end of the quadrant from where I had had it. The engineer or I did not touch the bar in the meantime. We did not see it move. I was not looking in the direction where I could have seen it; I couldn't have seen it if I had been, because the bar was behind me, and I was facing the tank. The bar moved from one end of the quadrant to the other by itself. When I saw the engine stopped, of course, I went out to investigate what the trouble was, and the cylinder head was out. And it had fallen off of the track. I started back up the track to where it fell, or was going that way, and Mr. Roy Fraley was fox hunting, and he happened to be right close to the scene, and he heard the crack and he came up, and when he saw me running back he motioned for me to go back to the engine and he would take care of the cylinder head. As to
356 how the cylinder head come to be knocked out: The engine was drifting backwards and the bar was in the backward motion, and, of course, when the bar flew out it went to the forward motion and changed the stroke of the engine; reversed the engine. And when it did that it did it with such force the follower head was knocked out. It could be different things that would knock the head out. Something acted in there that would knock it. The cylinder ring could be broken, the packing rings could be broken, and a piece of that could have knocked it out. The piston does not necessarily travel just the same distance whether you are working steam one way or whether you are working it the other way, because the valves could be so that the engine would be out in the forward motion and be all right in the backward motion, or vice versa. As to whether I thought that the mere reversing of the engine knocked the cylinder head out and that nothing else happened: That is the only idea I formed about it. I don't know. I inspected the engine but did not find anything else wrong.

"Q. What experience have you had on the Mallets as to whether or not the power reverse gear would permit the valve motion to creep?

"A. I have had that in some instances to do so."

In our territory we haven't one Mallet, to my knowledge, that does not permit the valve gear to creep. I suppose I have run every one of them. As to whether on any other occasions I have had that creeping to such an extent as to reverse the engine: I never had the engine to completely reverse herself, but I have had her to cut herself out, and I don't know what she would have done if I had not stopped her. Perhaps she might have reversed herself. As to what I did on those occasions: Well, for instance, I have been going up the hill helping a train and I would set the bar where the engine would do her work. I would imagine she would be doing her work by the sound of the exhaust and the movement of the train, and we would be going along very nicely, and all at once the engine would begin to go lame, and you would notice the speed of your train cut down, and I would just reach up and maybe I would reach up and put the bar down one notch, and perhaps she would take it all and go ahead. And I had only moved the bar one notch but she had taken the full stroke. The effect of putting the bar there all at once would be very severe, I would think, on a weak car. The engine, naturally, when she would go down, would slip a little and that would cause a jarring or jerking in the train, and she would slip if you did not have her on sand. I have never run one of our Mallets in the helper service, that is, the present Mallets that we have and have had that did not. I do not mean on every trip, because lots of trips you do not try to change the bar, because we have a coal train and there is only one place for the bar, and we put it as far as she will go. I then left it in the corner. The trips I had with the bar working that way were when we were helping a "Q. D." train, or a fast train, as we call it. I can tell you it is not every trip because lots of trips we don't change the bar, and I wouldn't know whether she slipped that trip or not. I mean the trips where I had changed the bar. I have never been able to change the bar where I wanted to change it and keep it for the 12 miles. I am speaking of the helper service now. That is the experience I have had. In this one instance of the engine I fired regularly for about 12 months on this passenger train, there was only one of the hand-powered, and, of course, it was not like it is now. By that I have reference to the fact that our engines are all in pool service now. We had regular engines, and naturally we took pride in the engines and kept the bar up and kept it well oiled and kept the valves well oiled, and we had plenty of oil, and I would say that the bar was in a hundred percent shape. As to my experience with the hand type of geared engines since they have been in pool service: I have never had an engine to leave where I would set it with the hand reverse, the hand power, I mean. The hand
358 bar would stay where it was put. For the efficiency of operation and saving of fuel and water I would prefer the hand power to the power reverse gear. From all standpoints I would prefer for safety the hand-operated reverse gear. I say that for this reason: For

instance, if I want to get down on the ground to do anything around the engine, I feel perfectly safe when I set the bar with the manual power, so that it will stay there where I put it until I get back. Otherwise I have seen and had experience with power reverse where they did not do that; they would creep (T. 1389–1402).

I have never had the engine walk off during times like that. As to what extent I have observed the gear creep under those circumstances: I have been oiling around and directly I would hear the valve motion going to move or hear the air blowing and I would look up and the valve would be going up or down and I could see it move. Of course, under those conditions when I would see that I would get away from it. I would generally look up to see if there wasn't someone fooling with the bar. I saw that occurrence when there was no one moving the bar. That has occurred on different occasions, more than once. I would not have much of an idea how many times, though. I don't recall any time just recently that this gear crept when it was standing still, because I have not run an engine or I have not been on the engineer's list for a year. As to what I had reference to when I spoke of hearing the parts move or hearing the air: That is of the reversing gear or in the reversing gear that operates the air, the reverse bar, that changes the throw of the valve. You can hear it blowing when you go to move the engine. When you move the bar either way there is a certain amount of these blows. That makes sort of a hissing sound. I heard that on several occasions when the engine was standing still and there was no one pulling the bar in the cab.

359 CROSS-EXAMINATION

I have had about a year and a half of running. It was not a year and a half straight time. I never ran regular running on the regular extra list more than six months' straight time. That was in 1926. I had a helper job. The engines were mostly Mallet power-reverse. The other portion of the time I was set up and running as an engineer, I was in the same service, and had mostly Mallets power-reverse; not altogether the Mallets. As to the other kinds of engines that are equipped with power-reverse: The 4400's and ——; they were Mikados. The biggest majority of my experience when I was set up and running was with power-reverse. It was not altogether in helper service. I was extra, and sometimes they ran a work train out of this place or a switch engine. I would say two-thirds of my time has been on the Mallets, on the helper job since 1914. On that helper job I am running at slow speed pushing, all except in the passenger work, I do not have much need to hook up or let down the lever in the slow freight. As to whether I would prefer to have the hand-reverse on the Mallets: I never had the hand-reverse on it and I wouldn't know how they would act. I don't mean to tell you it is hand-reverse on a Mallet engine, because I never used it. I am familiar with what a hand-reverse does; but not on a Mallet engine be-

cause you have bad engines there to control with power-reverse, and I don't know how it would be.

"Q. Wouldn't you have the same thing to do with it—change the motion of the engine?

"A. You would have practically the same thing to do, but I would know which prefer because I have never had any hand reverse on a Mallet."

For my own personal safety, I would favor having a hand-reverse on the Mallets, because I have never been hurt by a hand-
360 reverse and I have by the power-reverse. If I knew that other men on my road had been injured in handling the hand-reverse that would not necessarily change my opinion, because I know other fellows get hurt with other things on the railroad that I have not been hurt with. I would have to see it myself.

The Mellin power reverse is connected up with the long bar and then there is a shorter bar that runs up to the quadrant, and that operates the air. The long bar throws the valve. When you raise it this little bar—there is a cylinder alongside of the bar that the air forces in there and you change your bar wherever you want it. The long bar is just the same as the ordinary manual reversing lever and it is connected up to the link motion.

"Q. Then all that the auxiliary bar does is operate the air cylinder?

"A. It operates the bar, of course, the big bar.

"Q. Where is the air cylinder attached to the big bar?

"A. This little bar comes up beside the big bar, you understand. It is on one side of the quadrant and the big bar is on the other, and they operate in unison, I think.

"Q. And the air cylinder connects to the reverse lever itself, the long bar. Is that right?

"A. Oh, no.

"Q. Or it is to the reach rod?

"A. To the reach rod."

On the occasion when I was injured I was running the engine. I was crossing over from the eastbound track to the westbound track at Terra Alta in order to return back to M. & K. Junction, or to Rowlesburg. When I crossed over and got on the westbound track I went to reverse the engine and she wasn't clear down when I went to reverse her, and she went to the corner with me in the forward motion, and I wanted her in the back motion (T. 1402–1412).
361 The engine was standing. I couldn't tell you just how far from the corner the lever was but it wasn't far enough from the corner to keep from giving a pretty hard jerk. I wanted to move it from that place on the forward part of the quadrant to extreme rear motion and I took hold of it and it pulled. I took hold of it and disengaged the latch. The lever went to the corner as far as it could go, to the boiler head. I couldn't specify whether it had happened on that trip or not. On this special trip I could not say how my engine was lubricated, but the engines generally are

lubricated good, because we have a very slow run and we have a good chance to distribute the lubrication. I don't know what caused the lever to go forward, but there was something wrong. It got too much air or something. I don't know what caused that.

"Q. For all you know, Mr. Fraley, it might have been that the valve motion worked hard and that communicated the force back on to the long lever? That would do it, wouldn't it?

"A. I suppose it would."

I would think that a lever which will jerk you as that one did would be unsafe. But this particular time I absolutely know that this was unsafe. Any lever which would give me a jerk so as to strain myself as that one did, I would consider unsafe.

"Q. So if manually operated Johnson bars do jerk an engineer so as to produce any kind of a strain you would consider them unsafe?

"A. If I was running manual power and it would jerk me and hurt me I would consider it—No, I would not consider that as unsafe as the other, because I could control that and I cannot control the air reverse.

"Q. But I am asking you the question if it does that you would consider it unsafe?

"A. I would for that special moment. But I could maybe overcome it and make it safe.

362 "Q. That would not overcome the injury you had, would it?

"A. No."

I said I preferred the hand operated reverse from the point of view of safety to the power operated reverse for the reason that when I was on the ground I could set the bar and it would stay there; and I had reference to the times I mentioned when I observed the block working on the link and the engine was standing on the ground and the air was cut off. That is what I had in mind when I said the hand reverse was safer. With this Mellin gear I don't think it is possible to reverse the engine without using the air.

"Q. Can you cut out the air and just use the long lever?

"A. No, sir; I don't think so.

"Q. You know that that is the case, that you can't cut out the air?

"A. I know it is the case that you can cut the air out—positively, yes.

"Q. If you can cut the air out then why don't you operate it with the air cut out?

"A. The only time I ever cut the air out of one of those bars was when I had it set where I wanted it, and then I would cut out the air and keep it from going ahead or coming back.

"Q. But if you think one bar which does not use the air is operated safer why don't you always operate the Mellin engines with just manual power?

"A. I don't think it can be done, because I have never seen it done and have never tried it.

"Q. I thought you just said you were able to cut off the air?

"A. When I get the bar set there is a little valve alongside of where the brake pipes come up and that governs the flow of air into this air valve that reverses the engine. When you get your engine set you can cut that flow of air out and your bar has to stay
363 there." I don't know whether you can then move the bar with the air cut off or not.

I was hired as a fireman in 1910, and was promoted in July 1914. I was never regularly assigned to the engineer's list until 1925 or 1926. I don't know when it was. But in this time I did emergency work. I don't know my date on the engineer's seniority list. I can tell you when I was promoted. It might have been six or eight months after that, or a year. I don't know when I made my first trip. We have a seniority list that tells, but I don't know just when that was. I belong to the brotherhood of firemen. I did a considerable bit of emergency work; I suppose up until 1926 half of my work, or, rather, all of my work, was emergency work. I did perhaps three or four months altogether of emergency work. I did not work as long as a week at a time. I would work when I might not make one-third of a day or one-fifth of a day. We were working on a trip basis then. In emergency service I did running between Terra Alta and M. & K. Junction, in the helper service, and between Blaser and Rowlesburg in helper service; and sometimes from Rowlesburg to Keyser, W. Va., in freight service. I have not had any passenger experience; only as helping. I have not had any yard service. In freight service that was through freight. In that service I did very little switching, but I would do some. Perhaps the longest I ever worked regularly on the engineers' board would be about four months. At that time I was in helper service but not exclusively. I had the same work—helper, on this coal train and the work train, and so on. Altogether in my experience up to this time, I don't think it would be more than a year and a half that I have been running as an engineer. I have used a manual reverse lever on the 2800s. They have a leading truck and the pulling truck, a four-wheel connection.

"Q. By Examiner ROGERS: How many wheels to the truck?

"A. One.

364 "Q. The leading truck?

"A. One on the side, the pony truck."

There are four driving wheels on the side. They did not have a trailer. That would be a 2–8–0, a consolidation. The weights on those drivers are about 160,000 pounds. We have used those engines in helper service as passenger helpers, and work trains. I would be on a locomotive of that character as an engineer for a very short time. I don't think I would be more than 30 days all-told. I had engines with manual reverse in freight service. That was an 1800 type of engine. (Mr. Kirby said that the wheel arrangement of that engine was 2–8–0 and the weight about 165,-

000) (T. 1412–1422). That would be in my through freight service. I could not give you an accurate answer as to just how long I worked in that service with the manual reverse lever, but I would think it would be about the same length of time with that engine as I had with the 2800, that is, about 30 days. It is mixed service and we do not get the same engine all of the time. Maybe we get her today and then maybe we wouldn't get her for a week in that kind of service. My estimate is that on passenger and work trains with manual reverse I worked a total of about 30 days as an engineer. I figure that in freight service with manual reverse gear I also worked a total of about 30 days. That is as near as I can come to it. For the balance of a year and a half that I worked as an engineer I had power reverse. It was partly in helper service and partly in freight service, that is, the other 16 months. I had the Mallet and some Mikado with the power reverse.

"Q. And what kind of power reverse did you have on the Mallets?

"A. The first I had was the Mellin. No, no—the Ragonett and the Alco.

"Q. Did you say "no" as to the Mellin?

"A. No; that was the first we had—the old style when they first came out."

365 I used the Millin, then the Ragonett, and the Alco. As to the type of power reverse on the Mikados: We had the Alco and Ragonett and screw reverse. The screw reverse is the manual reverse. I have had some experience with the Barco, too, on the 4400s, the Mikados, but very little. They are all so near alike, the Ragonett and the Alco and operate so nearly alike, that I just don't pay much attention to them. The Barco also operates like the others. I think it is the same thing. The Barco is on the Mikado engines.

"Q. And you think they are all the same thing, do you?

"A. Well, they operate.

"Q. That is, do the Mellin and Ragonett and Alco and Barco, all work alike?

"A. No, sir; the Mellin does not."

I had experience with the Mellin from the time they came there in 1911 or 1912 to the point where I am working until 1928. As to what would be my judgment as to the total time I ran engines with the Mellin power reverse: I cannot give you that because I was on them—I fired them all of the time that they were there and I had experience with them each and every day, because I would handle the engine sometime or other during the day. What I base my experience on on that question is the time they came there until 1928, because I handled them each and every day. But I could not tell you how long I was running them. I could not tell you how long that would be because we have a mixed service there and I could not tell you just exactly how long. If I answered those questions by, guesses you would have me railroading or running an engine 40 or 50 years. I want to tell the truth about it. For six years I figure

I would operate the engine at least one-third of the time when I was firing in helping service. The engineer was doing my job, firing. Part of the time it was hand-fired engines and part of
366 the time it would be stoker-fired engines. When I am actually working in helper service I have occasions to use the reverse mechanism.

"Q. For what reason do you operate the reverse mechanism, Mr. Fraley?

"A. Well, you would have to operate the reverse levers in several different positions to get into and out of the yard with your train, wouldn't you? Do you mean after I am going with the train?"

In operating my engines for the first trip I would operate the bar possibly as much as seven or eight times before I coupled up to the train. By "first trip" I mean starting my day's work. This would be a daily occurrence. I have started in the day's work immediately when I got the engine, and I have started at the half of the day, and I have started when we would go to the top of the hill, and I have run the engine back down again and I have also run it up again and acted as the engineer for the complete 8 hours lots of times. When I acted as engineer for 8 hours the engineer would be doing my job, firing, protecting, and looking after the firing. I know who my engineer would be on such occasions. I cannot tell you where those trips have been in the last six years. For the past six years the engineer is Mr. Fraley, who is 52 years old. The other engineer I had was J. H. L. Pugh. That was not the Mr. Pugh who was on the stand yesterday; he was another one. I suppose Mr. Pugh is a man 53 or 54 years old. Not then, he wasn't. That has been more than six years ago. I suppose he was a man 50 years old then, or 52. Those engineers would fire and let me run the engine. There was no reason why the engineers would let me run the engine and they fire, only just for courtesy's sake and give me a little experience at running.

You would use the reverse lever a number of times before you hooked onto the train you were going to help in order to get back from the ready track, you would go to the pen stock and take water and reverse her there, and you would go out on the
367 main track and come back and get your caboose and you would reverse her again; you would go up against the train and you would have to reverse her again, perhaps, if you did a good job coupling up, and if you didn't perhaps you would have to reverse her two or three times. With the manual reverse bar, if I wanted to reverse her I would reach up and get her and pull her back. I would take both hands if it so required. My customary practice with the most experience I had with the power reverse was with the left hand. With manual power I would use my left hand. As to whether this was my customary practice, to just do it with my left hand. With the most experience I had handling manual power that would be my way with the certain engines that I handled. That was one of the snapper engines, 1800s, on the passenger helper.

During the time I was getting the engine from the place of origin to coupling up to the train I would have to observe signals. When I was observing those signals I would be in the forward position and also the backward motion. I would take signals both ways; going out I would get the signals from the front. I could be sitting on the seat box or standing up. I couldn't say which. With this special engine my custom in coming out like that would be to be standing up. I got the signals from both the front window and the side window, but the customary thing would be from the side window. In extreme warm weather it would not be from the side window but from the front window. It could be from there. I could have the front window wide open. I might see the target and see the brakeman making a coupling from the front window. On these snappers the cab is pretty well ahead of the boiler. When I am taking signals at the side window I can reach my reverse lever and reverse the engine from that position. If I was sitting in the cab I would not be leaning out. I would not necessarily have to be leaning out the window to see the signal. I would be sitting
368 there. I would not be in a leaning position. With the leaning position I would have my body out. But I would not have to do that. I would have my arm on the arm rest and could reach the reverse lever and reverse the engine. I will not say that I lay there with my hand on the hand railing, because I do not remember whether I lay my arm on there or not; but I could have if I wanted to. It would require very little pull on the lever on this engine we are speaking of, to pull it out of full forward motion into backward motion. It would require more than five pounds pull. I couldn't tell you about the weight, but I could reach it there and do it very easily.

"Mr. MOREHOUSE. May the record show that the witness demonstrated with his left hand while remaining seated and making that answer?"

This was a slide valve on this locomotive (T. 1422–1434), but I don't know the name of the link motion. It was the Stephenson gear. I have not made a study of reverse gears. I had to pass an examination when I was promoted to engineer but when I passed the examination they didn't have those. They didn't confine the examination just to the reversing gear. As to whether they had an examination on the reversing gear: I believe we had to name the type of valve and working parts on the engine. I am familiar with the reversing mechanism; I can operate it. I am familiar with the construction; in my way I am. I am familiar with it enough to handle it or they wouldn't allow me to handle it. On the manual reverse gear you have the rocker arm and tumbling shaft attached to the reversing bar. You move the valve whenever you move the bar, and the reach rod; links. Those appurtenances weigh a hundred pounds, and you move all of those when you pull your lever. As to whether there is any difference in the amount of strength required to move the lever at any point in the arc from full to forward motion to full back-
369 ward motion: I would say not when it is operating as this engine. There was no point on the quadrant that it was any

harder to move than it was from the full forward motion to the full backward motion. This was an engine that we helped passengers with and we took special pride with this engine and looked after it, and this bar was 100 percent because it didn't lack for oil. And this is the one I am giving you my experience on.

"Q. Is that the only one you are talking about all of the time during your testimony?

"A. No, no, not during my testimony. I ran other engines with manual bars."

There were other engines that were 100 percent perfect, like the one I described. I have been on them that was and I have been on them that didn't, that is, I have been on other engines where there was no variation in the strength necessary to move the lever throughout the whole of the arc from full forward motion to full backward motion. I couldn't see any difference from one point to the other. If I tried to reverse the engine with the cylinders full of steam or if the engine was not properly lubricated, it would probably require more power to reverse it. I couldn't see necessarily why it would be any different when it was properly lubricated.

"Q. It would handle just as easily, would it, if you were trying to hook up the engine?

"A. That is, under the steam pressure, you mean?

"Q. Yes; when you are running.

"A. Sure, there would be more. It would require a little more effort, I suppose, to pull her up than to drop her down."

I have done it with one hand and seated on the seat box. I am not saying about the arm or the arm rest. I have stood up and did it with one hand and sat down and did it with one hand. I am not
370 positive that I have a foot brace on that locomotive, but if she didn't have she should have. I have seen them on there. On this 100 percent one, I don't know whether you would call that a foot brace or not. It was a bolt run through the end of the quadrant. We used it for that. I don't know whether it was for that purpose or not. If I thought it was necessary I would use it for a foot brace. I have seen engines that would get dry and if I wanted to fool with them I would ease the throttle off, and, of course, I would take every precaution to keep it from going down further than I wanted her to, and I would put my foot on this brace, or whatever it , and hold her and let her go down whenever I wanted her. By "fooling with her" I meant if I wanted to drop her ahead or drop her back.

"By Mr. STEVENSON:

"Q. With this 100 percent lever that you described what would you want the foot brace on that one for, Mr. Fraley?

"A. I told you I don't remember that she had, but I say you absolutely wouldn't have needed it if she had."

They have a bolt down there in the end of the quadrant. I don't know whether that is put in there as a brace or what it is for, but I would use it for that if I wanted to. Possibly I have used

it if I wasn't familiar with the engine. On the 100 percent engine I never used it. I have hooked up that engine when it was running, but I never used the foot brace. I don't know that I braced my feet anywhere. It would not have been necessary for me to. Certainly I have used two hands on it. Maybe I would grab her and throw her back or cut her up, or if I had two hands there in doing anything I would do that. The number of that 100 percent engine was 1813. Possibly three-fourths of the time the engineer on that engine was J. H. L. Pugh. Mr. Pugh is now in Rowlesburg, W.Va.

371 "Q. What was the number of the engine you had where Mr. Fraley was your engineer?

"A. All of them, that is, all that run in that——"

Mr. Fraley was never engineer on the 1813. He permitted me to run for 8 hours a day all of the Mallet engines at M. & K. junction, the 7000—any engine he was liable to be called for. None of those were one hundred percenters. I have never seen one of them yet. They are not in our bunch. I don't think I have ever fired a manual reverse engine for Mr. Fraley. As to how they worked: This one worked. I am not sure about this. I cannot answer positively whether I have ever fired one for Mr. Fraley or not, because you see we jumped from one engine to another in making our day, and sometimes we run three or four engines in making our 8 hours. I have had locomotives with the manual reverse that I couldn't work them, as I did this one engine. I have had them that would work hard. When it worked hard it would require more effort to reverse it or drop it down or move the bar. To move the bar it would require more effort. I expect I have had one where I had to use the foot brace during my time, but I don't remember of having to here lately, not in the last four or five years, because I have not handled but very few of them. As to whether when I was working with manual reverse I ever had one where it was necessary to use the foot brace all of the time: Not all of the time. I have perhaps had it when I would go to use it sometimes, when I would have to use it during the day, and perhaps other times I would not. That was all depending upon which way I wanted the bar. If I was moving the bar down I could do that better than by cutting it back. When you go to cut it back perhaps it will require the foot brace; I don't know. I couldn't say positively whether I used the foot brace. It has been very seldom that I ever had to take both hands and use the foot brace on the manual reverse. Possibly, it might be that I have done that, but I don't recall ever having done that—using both

372 hands and the foot brace (T. 1434–1444). I guess I can recall of using the foot brace. I am not positive about that. I have used the foot brace, yes. When I was using the foot brace, I suppose I used both hands on the reverse gear. I would not have known whether it was necessary or not, but I used that as a precaution against getting away from you or going to the corner; I don't know. I never remember of taking special precautions to brace myself.

I might have done it unthinkably or I might have done it just to make it easier on me, and I don't know why I did it. I might have done it unthoughtedly. I never remember bracing myself in order to keep from getting jerked or anything with this special engine. I will say this, I did not do it in order to keep from getting jerked.

By Mr. STEVENSON:

"Q. Mr. Fraley, is it a fact that on this 100-percent engine you have described it was never necessary under any circumstances for you to take hold of the lever with both hands or brace yourself?

"A. That question is far-reaching. Perhaps I might have tried to do that when I had the throttle open or something and it might have been with the engine standing and the cylinder cocks and the steam condensed in there, and it might have been then that I might have had and done it."

I can't remember that there was any circumstances under which it was ever necessary on my 100-percent engine to take the lever with both hands and brace myself. I would not say that there was not, because I don't remember of ever doing that. I do remember that I could sit on my seat and have my arm on the rest and move it at all times with my left hand back and forth; I have did it. Whenever I wanted to I could reach there and get it. I have done that. I remember that well, but I don't remember ever happening to get my foot up in the window or against the brace or any place to do that. I have had other engines with the manual re-
373 verse lever when it was necessary to take hold of it with both hands. It was also necessary to brace myself when I took it with both hands. I remember of that happening with a 2800 that was a new engine out of the shop. I remember having it occur on that engine, that it was very hard to reverse. It would not take all of the strength I had to reverse it. It would take right smart strength. It would take right smart strength in hooking it up when I was on the road because the parts were new and the engine was neat and hadn't got properly lubricated yet and it would require right smart strength. When I was using the manual lever and in the act of hooking up I did not first raise the latch. If I were hooking it up the first thing I would do, I would ease down the steam pressure, ease the throttle down. I would not necessarily do that going up a mountain. I would not always ease off the throttle; not in that case. I wouldn't ease off on the throttle unless, the bar was working hard and I would use precaution then to keep them going too far or anything, and I would ease off the throttle, and I have done it. That wasn't my general practice, to ease off the throttle, not on my 100-percent engine. I could have that just to suit myself. If I wanted to give her one or two notches I would give it to her. When I began to give it a notch the first thing I would do would be to reach over and get hold of it. When I got ready to let her down I would raise the latch. When I would raise the latch there would just be a little pull against the lever. Then I would set her down as I wanted her and let go of her. Besides this 100 percenter I

remember one, the 2800, the 2886, that I could do that with. I couldn't say that that was my usual practice. As to what was the usual condition with manual reverse levers: The usual condition in all my work around the engine is to take precautions every time, and I naturally, if I can do it easier with both hands, I would do
374 it. If I could do it with one hand or if I was in a hurry or unthoughtedly and could do it with one hand I would do it with one hand. I don't remember that. I didn't say that I had a Barco power reverse when the cylinder head blew out; I said I had the Ragonett. We have no Barco on the Mallet engines that I know of, on our helping engines.

"Examiner ROGERS. I have it in my notes that you said Barco."

"The WITNESS. No, sir. We have no Barco. He asked me if I had any experience with the Barco, and I had the experience with the Barco on the 4400 on the Mikado engine. We have none on our Mallet engines."

If I said Barco it is absolutely an error. It was a Ragonett power reverse. As to which cylinder head blew off: The right front low pressure. I inspected the hand gearing and seen there was nothing wrong with it, that is, in the reversing mechanism, and pulled her back and went ahead. I ran her about 8 miles from there into M. & K. Junction with the cylinder head off. The piston was seemingly all right. As to whether there was any indication of the cylinder head that it was struck by anything: I didn't see the cylinder head. I don't know what caused it to blow off. There had to be something the matter with the air reverse or it wouldn't have reversed itself. I didn't see anything wrong with the cylinder. I didn't tie up the main track when I knew I could move in safety without making a special inspection. I didn't inspect the air cylinder, but I knew I had power to reverse her and go ahead, and I went ahead. After the cylinder head blew off I could still operate the air reverse, and as I wished. The main cylinders to the engine ain't filled with air; they are filled with steam.

"Q. What do you think was wrong with the air reverse that caused the steam cylinder head to blow off?"

"A. I simply said I thought the cylinder head naturally would not have blown off; if there was anything wrong outside of the air it would have blown off before that, wouldn't it? If the engine hadn't reversed herself I don't think the cylinder head would have come out."

I was moving at the time possibly 15 to 18 miles an hour.

REDIRECT EXAMINATION

I have never had the hand-reverse lever on the locomotives I have operated act in the manner that the reversing bar on this Mellin gear acted as I described it. I have never had them jerk or fly from one position in the quadrant to another as I described my experience with respect to the Mellin gear. I weigh 145 pounds.

I have never had an injury that required me to be off duty but I have had thumps and bumps several times with the Mellin gear.

By Mr. MOREHOUSE:

"Q. With reference to the times when you cut off the air of the Mellin gear, as you explained, so that it would stay in one place, when the air was cut off how was the gear held in one place?

"A. I have seen them when the air was cut off that they would still work back. But we have some—I have tied them down. I would take wire."

They did not have any sort of a latch. I have tied them down. And I have also put the grate bar shaker and put it in behind the stoker pipe, and I have seen them come back and bend the shaker bar (T. 1444–1456).

376 ROY FRALEY, locomotive engineer for the B. & O. R.R., and first cousin to Mr. J. B. Fraley, living at Terra Alta, W.Va., and 52 years old, testified:

I work in the same territory that Mr. J. B. Fraley mentioned. I was employed by the B. & O. on September 8, 1896, as what I would call an ash-pan scraper, common type. I started firing an engine in 1898, and was promoted to running an engine on September 22, 1902. I started running after three trial trips to get my papers signed up as qualified. Since that time, all except six years and eight months of my time I have been running an engine. I was out from December 22, 1918, until—I just forget what date, but to 1925. As to what types of engines I operated as to the range of weights on drivers up until 1918: From about 130,000 pounds to about 472,000 pounds. The 472,000 pounds was the Mallet, 7200. I have run the 1600; it was a pony truck and a four-wheel connected engine. I did not run any engines in passenger service. I was in through-freight service. I had other types of engines in that service other than the four-wheel connected. They were the 1800, what they call the turtle-back. That is the type that Mr. J. B. Fraley described as a snapper. Both of those types I have just mentioned were equipped with manual reverse gear. The Mallet had power reverse gear. There were no other types equipped with the hand reverse that I operated; not before 1918. Since I have been back on the job again, since 1925, I have operated the 2800, the 4400, and the 7000's, and maybe a trip or two on the 7100's, Mallet engines. Those 7000's and 7100's are the Mallet type. Since 1925 I have had one engine equipped with the manually operated reverse. That was a single trip. I did not even finish

377 my day on it—just by the trip. Prior to 1918, practically all of my experience, except, I suppose, something like two or three years, was with the hand-operated reverse lever as compared with the power reverse. During those two or three years I was using the power reverse on the Mallet engines. I believe the ones I operated then were either the Alco or the Ragonett. The engine I ran was the 7104. We had regular engines at that time. Since 1925 the

principal make of power reverse gear on the engines I have operated was the Mellin, I believe they called it, on the 7000's. I have operated since 1925 with power reverse gears of other makes than the Mellin. Occasionally we get a through-run engine, a 7100, that we cut off there and we get a trip on them. I do not know what makes of power reverse gear those are. The Alco and the Ragonett, I believe, are the two makes we have on those engines. I have never received any injury caused by the hand reverse gear. As to my experience with them as to the physical effort that was necessary for me to exert to handle them and as to whether or not it produces any strain on me in any way physically or mentally: It never caused any strain any way. Of course, sometimes it takes a little more for one than the other, that is, running different types of engines. But I have never gotten one yet but what I could reverse it all right. I was the engineer the day that Mr. J. B. Fraley's back was strained or wrenched. I did not see any part of that accident. At the time I was at the telegraph office receiving form A, which you would call a clearance part. I was not on the engine or at the ending at the time. I had observed the action of that Mellin reverse gear on that day; I had handled it myself prior to that time. My experience with the handling of this Mellin power reverse gear, as to how they acted and to what extent they control the engine or the reversing gear of the engine: Sometimes you would get one that would work probably tolerably good and at other times you would get some
378 that you had to stay in the clear of, and if you didn't they would put you in the clear. The main thing was to stay out on the side away from it. The reason for that was to keep from getting it, because there was never no assurance which way it was going to go until you would get it started. That applied to when I was trying to start, putting it in the position to move it.

"Q. Does that statement also apply to when you were running over the road and not attempting to make any adjustment of it?

"A. In fact, I never did do that."

It did not have any tendency in my experience to move back and forth, other than when you were adjusting it. I don't think it did.

The Mellin has two bars, one to operate the air part on the reversing gear and the larger bar was to operate the direction and the way of the valve. Whichever way that went it would operate the valve.

"Q. Was it the air cylinder that operated this large lever?

"A. Oh, yes; the piston would.

"Q. The air cylinder?

"A. The little bar had nothing at all to do with that. That was the control of the air—the way you wanted to control the large lever." All I operated was the small lever.

I never saw anyone injured with the Johnson bar type of hand reverse, nor have I ever seen one of the Johnson bar type of hand gears jump out of the quadrant or become unlatched by itself and go to the corner.

At the time Mr. J. B. Fraley was injured, when I got back to the engine, he was sitting on the seat and made remarks when I got up on the engine that the bar had jerked him and hurt his back.
379 If I am not mistaken, I think he continued the day's work. He was firing regularly for me at that time. He did not continue to fire the next few days after that for me. When he came back to work he did not make any complaints as to the condition of his back.

"By Mr. MOREHOUSE:

"Q. What I mean is, Mr. Fraley, how about whether J. B. Fraley made any statements or remarks with respect to his injury?

"A Not any (T. 1456–1466). At the time I returned to the engine he did. He said that he went to reverse the engine and that it had jerked him and hurt his back. He did not say anything further. I have always found plenty of room in the cab to operate the bar. I have never experienced any difficulty in maintaining a look-out for signals or highway crossings on account of operating the hand-lever type of reverse gear; I never found no difficulty. With respect to my experience in the operation of the hand type of reverse gear as to whether or not I was able to maintain a fixed point of cut-off in running my locomotive: I found no difficulty whatever but what I could handle it. My experience as to whether or not it would stay at a fixed point when I would set it there: I never had any trouble in its changing from where I would put it.

"Q. With respect to the power reverse gear, what has been your experience in that respect?

"A. Well, that varies. Some of them would stay and some would not."

When they would not stay they would naturally move from about where you would think you would want to work them, either down in forward motion or back up in the cut-out. The operating lever of the power reverse did not move in those circumstances. As to what part it was that moved: It would be the valve part. I suppose it would be the cylinder. It would have to move where it is all connected together; that is, the piston, rather, not
380 the cylinder. I can't say that I ever made any observations by leaning out of the cab window to see what part of the power reverse gear itself was moving in those circumstances. I knew that the reversing gear was moving, or the valve gear, by the exhaust of the engine, heavy or light. As to whether there was any other effect of that moving of the valve gear upon the operation of the locomotive: It would cut itself clear out. I can't say that I have had it cut itself clear out. I have had it come very close to cutting itself out, so that you could just merely distinguish that you had it in the position you wanted to go at all. In cases of that kind I unlatched the bar and put it down toward the corner. As to the effect that had: It gave it the valve in the direction you wanted it to go. Afterwards I would not then again hook it up, because I

would be afraid to, afraid of damage. You might start to hook it up the next time and it would go clear back for you. I never had it go clear back. As to what leads me to believe it would do that: Because it had been working on me different times on my trip when it would try to cut back and I would be afraid to take too much. I always made it a point to shove it forward before it got over the center; catch it as soon as possible. That required more attention on my part than if I had been operating with a hand reverse lever; you had to be more careful with it. On those occasions when you had a creeping gear of that sort whenever you would want to move it you would have to be very careful.

"Q. What I am getting at, Mr. Fraley, is this. Did it occur frequently or infrequently?

"A. Some of them, after they have gotten it, it would be frequent until they are fixed."

I would get once in a while an engine on which the power reverse would creep in this manner. You didn't have it so often, that is, outside of that old Mellin type. They nearly all creep. You could hardly keep them from doing it. In what I have
381 been telling about the performance of this power reverse gear up to this point I have had reference to the Mellin type of gear. There were very few of those others I have ever run. As to those that I have run, what I have said about the creeping applies to some few, very rare; I found them very much better. There are lots of them that do not creep at all. I do not have the same engine, a regular engine; it is first one and then another. With these later types of gears, the Ragonett and Alco, I never had the experience of the control lever itself coming unfastened without my unfastening it. I can't say that I have had that experience with the Mellin gear.

By Mr. MOREHOUSE:

"Q. You said you didn't have very much experience with the Alco and Ragonett?

"A. No, sir.

"Q. About how much? Can you give us any idea?

"A. Well, I said I did not, but I am mistaken, because we have it on our 7000's. What I meant was those 7100's. We have them now on the old type of 7000's."

That is a Mallet type. The Mellin gear in former years that had been equipped, they were just exchanged and taken off. They replaced the Mellin with the Alco. As to the experience I have had with the creeping of the power reverse gears, since the Mellins have been replaced with the new types: I have had some that did not creep but some that would. We have two at the station at the present time that do not creep. I suppose those gears have been out a month, or maybe a little longer. As to the others that do not creep, some of them have been on the locomotives quite a while, that is, I suppose maybe four or five months, and then some practically new

out of the shop. I find that some of them which are practically new creep.

"Q. Have you ever had any experience with the new Alco and Ragonett gears being put on these engines when you had
382 them out and they did not creep and then you later had them after they had been in use so that you could tell us whether or not the same gear would perform any differently at a later time?

"A. Oh, yes."

There are different times you would get one that would not creep. and then maybe we would catch it the next week and it would creep. When I speak of creeping, I am referring to these conditions where the gear would not maintain the fixed point of cut-off. I am not stating that it would go into the corner every time it would creep or even cut itself out, but it would not stay where you would want it to stay. As to what in my opinion, from the standpoint of efficiency, that is, the amount of fuel and water used in operating the locomotive, would be the better, the hand-operated type of reverse lever or the power type: In the hand type you can set them where you want them and they will stay there, because there is no way for them, if they are properly equipped, to do otherwise, unless something would break, and, then, of course, that would be terrible. If the carriers want efficient operation, I mean economy with coal and that saving, they should have the hand gear instead of the power gear. Of course, if the power reverse would not creep or would not cause anything like that, it would be just as good as any other one, and easier.

From the standpoint of safety as between the two types of gears, the hand gear and the power-reverse gear, I prefer the manual-reverse gear because you have control of the engine regardless of anything else about it. As to just what I have in mind: That air or anything, if that engine is moving I can stop it if it starts with the power reverse. I mean the manual reverse. But if it starts with the manual I have no way whatever with no air on it. I do not mean the manual now; that is the power reverse. As to what I mean by reference to the air: For instance, say you had an
383 engine sitting out here and if it would get hit with another engine or something, and as soon as you bump it it would be descending a little grade, if it was a manual reverse—Well, before that I will say this, that if you see it start there is no person would want to get on it to stop it. With the manual reverse you would try to stop the engine. But if you were going on one with the power reverse and if it was going down a grade and you saw there was no air on the engine, absolutely there is no man who would stay on it where there is no way possible of stopping it. That is what I mean by that.

I have not had any experience in extremely cold weather with power reverse gears. I very seldom work any in the wintertime on account of throat trouble and rheumatism (T. 1466–1477).

I do not recall the occasion upon which the cylinder head was blown out of the locomotive that Mr. J. B. Fraley referred to in his testimony. After the accident I found the cylinder head. As to what I know about it, what I heard and saw: Some of them call it fox hunting, but I guess it is just general hunting. It was right at what they call Grave Yard Curve, a sharp bend, and I was coming up to the track on my way home, and I heard what I thought was an explosion. I could not see anything at the time, and all at once around the curve came the engine. As they passed by they stopped. I walked on up the track where the cylinder head was lying, and it was sitting up against the corner of the ties. I had a pretty hard job of it but I worked it down clear so that there would be no obstruction causing trouble to any other engine, and after I moved it, Mr. Fraley was coming up the track, and I gave him a signal to go on back, that it was all right.

384 CROSS EXAMINATION

My experience from the time I went to running in 1902 up to the time of my laid-off service in 1918 was mostly with engines which were hand-reversed. During those times, I was not in helper service a good bit of the time, once in a while we would be cut off at a helper station, but not permanently. I am in freight, through freight. The engines I had were regularly assigned engines; that is after I got off the extra list. We run extra until your turn comes to get a regular engine. I cannot just exactly name what year it was when I began to get a regular engine. Not after two or three years; I ran extra longer than that, quite a number of years, I remember; I suppose probably four or five years, if not more. When I got my own engine, I was able to see that that was kept in pretty good shape. I made it a point to see that the latch and quadrant were in good shape, and everything else; and whether lubricators were working. I cannot say that I had plenty of oil on my engine, so that I would not run out of oil. We had a certain amount that we had to have. I had the lubricator filled, and the oil holes on your valve motion and the different points of oiling, you saw that was kept clear yourself. You put no grease on the quadrant and saw that none was put there; and that it did not corrode in the notches.

"Q. And that no oil was put on the latch of the lever and the dog?

"A. Yes, sir, you could oil that."

You would not put that much oil on so that it would go through onto the quadrant. I cannot say whether it is so or not that when you do not have your own engine and have to take whatever one comes to you, that they are kept up as well as the one which you would have a personal interest in, because they have a man for each and every purpose, for all such parts. You are able to follow
385 the situation better and see that the work is done better when you have your own engine.

"Q. So that the reason that you had the experience that you did with manual reverse was because you kept the engine maintained in relatively proper shape. Is not that right?

"A. That is the only kind they had at that time."

Not regularly assigned engines and on the extra list. I mean that is all the kind of engines they had at that time was manual reverse power.

I said that there was no way for the hand-operated lever to jump out of the quadrant or get away from you if they are properly equipped and nothing breaks. If you have a condition where the latch mechanism or the quadrant is not properly kept and the latch spring is weak, the dog is rounded off or the notches of the quadrant are rounded off, then you have a condition where the lever might jump. And if the engine goes along and develops lost motion in the link blocks and in the other places of the link motion, the reach rod and the various connections on the lever, I could not say that lost motion likewise would have a tendency to make the lever jump out of the quadrant, if the notches were proper. Even if the notches are proper, and you have lost motion in the various bearings and the links of the reversing lever, it might cause the reach rod to vibrate, but it does not make them jump out of the quadrant. As to whether it would not have a tendency when the reach rod is vibrating or pulling back and forth, causing an extra strain to be placed on the reverse bar itself: That is different. You were asking the question whether it would cause it to jump out of the quadrant.

"Q. I am asking you this question now.

"A. There would be a little strain there if that happened, but it would not cause it to jump out of the quadrant."

"Q. Have you ever seen a reverse bar jerk and rattle in the quadrant going along?

"A. No doubt I have, to some extent."

386 When it shakes and rattles, that does not give a tendency for the dog to work up and out of the notches in the quadrant, not if the spring would be right. It would be easier for it to stay in rather than work out, if the spring was all right on the dog. If the spring was weak and there was nothing to push it down, it may work out, if it is worn the least bit. If they are in proper, of course, nothing would cause it to work out. I cannot see that there would be anything which would work it out. If the spring was too tight, that would be against your lifting the dog, what we call the latch dog. It is to your advantage to have a spring which is not too tight; we do not want it so tight that you cannot use it.

I cannot say that I have ever had any part of the valves foul, such as a strip coming off of the pressure plate on a Stephenson slide valve. I have used Stephenson motion with slide valves; these engines were slide valve engines in them days. The strip part on the slide valve can break or come loose, and the spring could get weak; the valve strip could break. I do not know that I have ever

seen a pressure plate broken. It could be, I suppose. It could come out of the alignment or if something would give way, they would. If that condition happens to them, I do not know that that would throw the valve mechanism out of square, out of order, unless the valve stem would break, or something like that; it might cause the engine to go lame. What I mean by that is you would have a heavier exhaust at one time than another, but you would not be completely broken down. As to whether if any of these parts would catch in the port, that would cause a disturbance in the valve motion: It is liable to break something then, of course. Then a strain would be placed on the link motion and carried on back to the reach rod, to some extent. I cannot say that it would
387 cause the lever to jump out of the quadrant. With the Meline type of reverse gear, the thing to do is to stay away from them, to keep from getting hit when you find out how it is working; not get in the way when you unlatch the air lever, so that it could come back and break your arm, hurt you some way, or drive your arm back against the cab. I have seen them break away and go to either corner; when you go to cut them off, sometimes they go back. They would go down with considerable force and with a bang sometimes (T. 1477–1486). The lever is something close to three feet long, the one you handle, on the Meline type of gear. I consider that a lever that does that is absolutely unsafe. The lever on the manually operated reverse is a little heavier than the one on the Meline type, and the sweep of it is about the same in the quadrant. I won't just exactly say that the Meline type is coupled up to the valve motion by a reach rod, but it is coupled up to operate the air into the cylinder to the reverse bar. That only handles the air part. Of course it is fastened to the reverse bar, but it is governed by this here one lever. There is one part of the Meline reverse bar which has a reach rod just the same as the manually reversed, only not so high, not so long. I would consider any reverse bar lever which is 4 feet or 3½ feet high unsafe, which jumps out of the quadrant. The manual reverse bar, when you unlatch it, it don't go two ways. It always goes in the forward motion, when you unlatch it, or whichever way you are going. As to whether if you had ahold of it when it started forward, it would give you a jerk: You don't set there ahold of it. I would not have hold of it at that time, if it jumped out of the quadrant like that.

388 "Q. But you would not know it was going to jump until it gave you the jerk, would you?

"A. I would not have hold of it at that time. You don't set there with your hand ahold of the reverse bar at all times." When you take hold of it to let it down a notch, you can almost tell whether it is going to jerk you or not. Of course, you do not take hold of it and let it have its way, but you take hold and have control of it. You must try it and see, control it. I have not had it get away from me and get in the corner that I can recall. The position I take when

hooking up or dropping down the lever would depend on where I was at. If I was on the seat one hand, and if standing up two two hands, just getting in the engine to start. When going over the road at 40 miles an hour, I don't take any position in going to hook up or drop down the engine. I sit on the seat box and brace myself. I have seen my engines equipped with a foot brace. I suppose they put them on there as a brace to keep from getting jerked, or something of that sort. I did not say that in my experience of a good many years, I have never braced myself when I was hooking up or dropping down the engine. You said running forty or fifty miles an hour. There is no man running at that speed who would want to drop any engine down. If he did, I would feel sorry for him. At that rate of speed, I do not think you would have any occasion whatever to hook it up, because you would hook it before you got to that speed. As to what speed you would hook it up: It depends on when you start out. You go up to where you think is a good clearance for the engine to do its work. The highest speed is about 30 or 35 miles an hour that I have ever run an engine. At that speed you do not brace yourself; at that speed you would not want to bother the reverse bar on a freight engine. On the engines where you would bother them, you do not brace yourself; I cannot say that I ever
389 have. It may be if the engine was new and the bar working hard, I may have braced myself to prevent any accident which may have been caused from it not working properly or working hard. I can't recall whether I have or have not. I have never had any experience on passenger engines where they were running 50 or 60 miles an hour. I said that I would be sorry for anyone that would attempt to hook up the lever going 40 miles an hour. Why would a man want to do that? Going at that rate of speed, it would be bound to take the bar away from him I would think, anyhow. A person has no right to touch it then, because there is nothing to be gained by doing it. I would consider it an unsafe operation to attempt to handle the lever at that speed. It would be unsafe because it might get away from him, pull or jerk him. I am not saying it would, but it might. I said that I preferred the manual reverse because you can stop the engine regardless of your air brakes. I cannot remember that I ever had an occasion when the air pump failed. I have been running with air pumps ever since I have run a locomotive. I have been without air. The one time I was without air, it was not a manual power reverse. I have never had the experience of getting without air on a power reverse.

"Q. And if the air should fail, you could cut in the steam on the power reverse, could you not?

"A. Not now."

Power reverse gears used to be equipped so that they could be operated with steam, but I think they have got them all cut out now. If they were reapplied, you would have steam to apply in case

your air failed. I do not know why they cut out the steam connection. While you were operating the power reverse, I never had occasion to use the steam connection.

390 With the Meline type, I have had to stand aside from the lever with some. You have to stand aside because you cannot always tell which way that lever is going to go, even though you unlatch it. The air makes the lever go that way when you unlatch it. Sometimes you cannot tell which way the air will make it go, when it is up near the center, because it may be that the air is still in the cylinder, and when you unlatch it it gives you a kick in the opposite direction before you put it in the direction you want it to go. As to whether it is the air which moves the lever which you have to step aside from: It is connected on to the reverse lever. The long lever is the one which you have to stand aside from; just the air lever, the one which you unlatch. That is the lever that hurt the other Mr. Fraley, that is the only one which could hurt him, because the other one is only about so long and cannot hurt anybody that is in a cab. The lever that controls the air can move in such a way that it can hurt a man. As to whether I know of any other type of power reverse where the air lever can move in the same way: Not that I know of from in the cab. I do not know of any outside of that that is being operated from the cab. I do not know whether the movement of the engine, where you have got the Meline type, affects your air lever or not. It is latched to hold it permanent, to make your adjustment of the valve where you wish to have it, to try to set it. That is just the same as the power reverse lever, with the latch just the same. As to whether the latch when not in the notch, with the movement of the engine, move the lever: The air is what moves them all. The movement of the engine does not. If you unlatch that and did not attempt to manipulate the air, I have known the air in the cylinder to move that lever. I do not know of any other power reverse where the air in the cylinder would move the lever. I have never taken particular notice of it, but you must gen-

391 erally have to move the small bar to get it to reverse the engine. You must generally have to make a move with your little bar. When you raise the notch I have never noticed any pressure on the little bar. I do not know of any other power reverse with which I have had experience that would injure fireman Fraley in the way I understood he was hurt. It is true that you could set some power reverse engines at whatever point of cut-off you desired, and they would stay there. I testified that I had run some engines with power reverse and I had set some few at the point of cut-off I desired. Then, later on, after they had been out of service a while I had the same engines and they would creep. I suppose the reason for that was that there was some worn part.

"Q. If the part had been kept in perfect mechanical condition, it would not creep, and if it had not been kept in perfect mechanical condition it would creep?

"A. That might be while you were on the line of road. I do not know that I can tell you what part it would be except the packing. It could be due to the packing being worn.

"Q. If the packing was kept properly repaired, it would not creep?

"A. That is one defect.

"Q. What was the other?

"A. I believe there is a kind of set screw underneath which would be worn, which will cause it, but which type it is I do not know. That could be worn a little."

If the set screw was kept properly repaired, I do not know whether it would not creep. This set screw is opposite the reversing cylinder, and it allows the air to get in just the same as a leaky gasket would.

It could be that if the ratchet or the quadrant becomes worn
392 on a hand reverse gear, that they will creep. If either one are kept in first class mechanical condition, they do not pump or creep; what we call 100 percent which means perfect. As to whether, if a power reverse gear, aside from this Meline, is kept in 100 percent condition, it will not creep: I have had some which did not creep and some which did, so that there was something wrong with them. I figured there was something wrong with the mechanism when they would creep. On these engines which I found creeping, I reported them and the majority of them were repaired. I cannot say how they functioned when they came out, because we were first on one and then on another. If the mechanism is in proper condition, I would not say all of them creep. I have had some which did not, as I tell you. I would call them a 100 percent engine as to reversing power. You cannot reverse a Meline type of gear without air in the cylinder. You cannot lift them, there is nothing to lift them with (T. 1486–1501). I could not say if this long bar which I spoke about had not been cut off, whether it would have been possible. I did not handle them at that time. When operating a locomotive that had a tendency to creep that she would get up so near the center that she would finally cut herself out, I would not let my cut-off be decreased to a point where it would cut itself out before adjustment if I could prevent it. If I notched it the other way I could prevent it. Most generally I would always do that. I do not know that I have ever let one cut out. That old type of Meline would take it away from you, if it is not working right. I do not get them at all now. They do not have them in service any more, not that I know of. There are engines that I know of where they took off the Meline power reverse gear and put on the Alco or the Ragonet. My company has not taken the Meline reverse gear off any engines and put on manual levers, not that I know of. When they took off a Meline gear, they put on another power reverse. You do not have the trouble so quickly
393 nor so bad, with any of the other power reverse gears that you had with the Meline, about them creeping back and forth in the quadrant, because there is nothing to hit you, as I told you a

little while ago, other than the little bar. There is nothing to interfere with you, but I have had them creep.

REDIRECT EXAMINATION

The locomotives that they took the Meline gear off of and put on the Alco and Ragonnet, were the 7,000 Mallet. I have had gears newly installed within 30 days which crept with me. They were of the Ragonnet and Alco type; they were the type which the' reinstalled the Meline for. We still have creeping gears on the locomotives, but they do not creep as quickly or badly as the old Meline type did.

"Q. You were asked regarding as to whether or not the worn teeth in the quadrant, loose latch spring, and various other causes might not have a tendency to cause the lever to jump out of the quadrant and become unlatched by itself. Have you had any experience of a hand-operated reverse lever doing that?

"A. No, sir; I cannot say that I ever have."

If a hand-operated lever was kept in 100 percent condition it will not do that. In the ordinary condition, such as I have found them on the B. & O., it will not do it. When I spoke of having a man for every job in connection with the keeping up of the reverse levers at the present time, now that we do not have regularly assigned engines, I meant that in the shop they have a man for such work. They have what they call a stoker man and a machinist, boiler makers, and all such things and also a man to oil around. They did not have those men when I went to running. As to what they had then to keep up the engines with: Machinists inside the shops, but
394 the engineers did their own filling of grease plugs and oiling, and so forth. They do not do that any more. Our engine is ready for us with the exception of oiling the hand gear, the guide, and so forth, on the ready track. These men do not do anything we did not use to do, but it has just relieved us from such labor. My experience as to whether or not those various men look after the reverse gears on these engines so as to keep them in good running order: They are supposed to keep them in first-class shape. I have had no trouble whatever with them that I know of.

I have never seen a hand-operated reverse lever act the way the Meline reverse levers did. I have never found anything in my experience that was unsafe in connection with my handling of the hand lever.

R. BROTHERTON, locomotive engineer for the B. & O., living at Glendale, Ohio, testified:

I work at Cincinnati and Hamilton terminals; was promoted to an engineer on October 22, 1904, and have been running since that time, right straight along. I worked as a fireman prior to that for five years. At the present time I am working in yard service. It has been mixed yard, transfer, and belt service. I was employed in 1904 and promoted on October 2, 1909, and went to firing five years

before that. I have been in this yard and transfer service all the time and that consists of switching in the yards and in the handling of trains between transfer yards. The last transfer work I did was from Silver Grove to Ivorydale, about 15 or 16 miles. That was Silver Grove, Ky. I have had city transfers, one-half that distance, about eight miles. Those are the only two transfer runs which I have had. The rest of my service has all been in yard and industrial switching on the Hamilton Belt. During that time I operated engines equipped with hand reverse gears about 16 years out of
395 the 22. That would leave six years, approximately, that I operated power reverse gears.

"Q. Do you mean by that six continuous and consecutive years, or are you giving us out of the total?

"A. Out of all of it, out of the total."

My service has been intermittent, part hand and part power. In 1919 I was on a trick which had an engine equipped with the power reverse for about a year. That was my first experience with it. This first engine, the weight on drivers was 163,500 pounds. I am speaking of the power reverse. The engines equipped with the hand reverse gears range all the way from 70,000 up to 221,000 pounds on drivers. The old style engines, the small engines, were equipped with the Stephenson slide valve gear, and those from 163,500 up to 221,000 were equipped with piston valves, both Baker and Walscheart. Those engines which weighed 221,000 pounds are the 0–8–0, E–27 type. I should correct myself. I said E–27. It is L–2. It was E–27 before being made L–2. The types of engines I have operated that were equipped with power reverse gear were the 0–6–0, E–30 and the two types of 0–8–0 (T. 1501–1510).

"Q. Was either one of those 0–8–0 types the same type as this hand gear engine about which you spoke a moment ago, L–2, I believe you said it was?

"A. L–2 is an 0–8–0 type."

There are some of them which are equipped with power reverse and some with hand gears. I have operated them both in the same service, at different times. I have not had any trouble in handling engines equipped with a hand reverse gear, that is, with respect to the strength required to handle them, and ability to do so. It has not affected me physically in any way, handling the reverse lever.
396 I weigh 155 pounds. I have never been injured or observed anyone else injured by a hand reverse lever. I never handled a screw type of hand gear.

I am 49 years old. During the time that I have been handling hand reversed levers, I have done other work outside of my regular hours of work as an engine man. In 1920 I purchased a small place in the country of 10 acres, near Glendale, at a value of $3,000. I made my own improvements on it, doing the work myself, without taking much time from the job, until today it is valued at about $15,000. I have rebuilt the house, built a barn, garage, and several large chicken houses, and planted an orchard of 500 trees. The trees

are around 7 or 8 years old. During that time, when I made those improvements, I was operating engines equipped with hand reverse gears to the extent of about 100 percent, that is, when I was doing the heavy work, beginning in 1920 and from then on. I mean I was putting up the house. That was in 1924 and 1925.

"Q. Since 1925, to what extent have you operated the hand-reverse gears?

"A. In the last eight months it has been about 50 percent. Prior to the last eight months, it was continuously power reverse for two years, two years prior to eight months ago."

I never experienced any hand-operated reverse lever coming unlatched by itself and going into the corner. I never had any get away from me. I have never observed anything in the action of my hand reverse lever, which I handled on the B. & O. which made it necessary for me to take any precautions against personal injury (T. 1501–1514). I have never found anything dangerous about them. There has never been anything about the operation of the locomotives which I have used with the hand reverse lever, that my operation of the lever interfered with my ability to keep a lookout for signals or highway crossings, or any other way to keep
397 a lookout. There has not been anything about them which interfered in any way with the safety of the operation of the locomotive. With engine no. 641 I had considerable trouble with the gear from crepeing or pumping. That is the L–2, 0–8–0 type engine; one of the 221,000-pound engines which I spoke of. I had considerable experience with the gear pumping. By "pumping" I mean the piston would kick her back and forth for a short stroke. It is more of a local expression. There would be a short piston travel, about two inches, one inch variation each way. I am referring to the power reverse. In turn, that would mean that you would lose control of the entire valve motion of the engine. I am speaking of the piston in the power reverse cylinder. It was a rapid movement. At times you would not be able to put your hand on the reverse lever without it kicking, and I have had my hand bruised from having the lever kick, and at times it would get to kicking and I would have to take my foot and kick it down into the corner in order to stop it. I am speaking of the operating lever of the power reverse. I kicked it down in the corner with my foot because I could not get hold of it with my hand without running a chance of having it bruised. That is the E type Alco power reverse gear. If you get the engine on the ready track in the morning and start the pumps, as the air would pump up, why, the valve would creep, or as the air would pump up the valve, the power reverse would move, and in turn moving the gear with it. When I refer to the gear, I mean the valve gear. I have observed that more than once. On this particular engine most any time you would start up, that is, start up the pump with no air in the main reservoir, you would observe it. That is on the 641 engine I am speaking of. Most every day I had experience with the gear creeping on that

engine, for over a period of about a year and a half. I reported it quite a number of times, both written and verbal, and on several occasions it was torn down and overhauled.
398 I did not overhaul it, the shopmen did. Then after a short while, there would be the same thing to overcome. It seemed as though the repairs on it were only temporary. I have had experience with reverse gears creeping on other locomotives which I ran, equipped with power reverse gear, other than 641. As to what extent: The type L–1A, which is an 0–8–0 also. This has an E–type of Alco also. It creeped, but it was not as bad as the 641. The greatest trouble with that was when you wanted to reverse the gear, you did not know whether you were going to get it over or not. On occasions when it did function you would have to pull on it, jerk and rattle it, and sometimes I had to move the engine a little in motion before it would start to take hold. That is, the air in the power reverse started to take hold to reverse the gear. I mean by that that I would give the engine a little steam. The number of that engine was 1072. For several days I had trouble with 1072. I would only get her a day or two at a time, in place of a no. 641. I reported the condition on the no. 1072. I do not know what was done as I did not get the train the next day. I would get that one particular engine about every 15 days. The next time I got it, the defect was remedied. It did not reoccur later on if I had the engine again, not to my knowledge. As to whether I had the engine again after the first trip, after it was remedied: Not for several days. I do not recall any other engines which I had, on which I had trouble with the power reverse gears creeping; those are the only two. No. 1073 is the other engine I ran with the power reverse gear, and it is an 0–8–0, the same type as the 1072. I have never had any trouble with that creeping, or, rather, I have never noticed it, but I very seldom ever got it. I have operated eight or nine power reverse engines in my territory.
399 There are three in this regular service which I am in, one of them is a 641 and the other a 1072 and the other 1073. Those three engines I have operated since 1926. The others were operated prior to 1926. I have operated the 641 the most, and the 1072 the next greatest amount. I had the 1073 thirty days last June and July. I have not had her since then. They are all equipped with the same type of gear. On several occasions I have had the pipe right outside the chest to freeze up, and I had to wrap waste around it and pour oil on it and light it in order to ease it up, before I could reverse the engine. That happened on four or five occasions on these same engines, the 641. When the reverse gear was frozen up in that way, I was not able to reverse the engine from the cab; had to thaw it out first. It took 5 or 6 minutes to thaw it out. The gear was frozen ahead. In that situation there is no way you could have moved the locomotive backward before thawing out the gear. Going out of Hamilton there is a pretty good hill, 5 miles long. With a heavy cut, it is necessary to get a run up this hill,

and on several occasions it has caused me to hang up on account of the power reverse getting to pumping. Cutting out the control of the valve caused the engine to hang up. By cutting out the control of the valves I mean shorten the piston travel, the valve travel. I have had the experience of the gear reversing itself and causing the engine to reverse itself. When you want to take hold the reverse lever on the power reverse, it would start to jerking, and the gear would pump, and cause a chattering of the reverse lever, which would cause it to jump out of the notches, and on several occasions it went over in back motion. That happened on several occasions on engine 641. On those occasions I used my foot on it to avoid hurting my hand, and put it down in the corner and started over again. As to how fast we were going in that service when those things happened: You
400 cannot run up that hill very fast; we do not go over 25 miles an hour to get over the top. With respect to the time the valve gear worked into the position where my engine was in reverse, I used my foot to move the lever just as soon as it started to do that. If there was a short cut-off, we got practically no warning. I have been injured by a power reverse gear (T. 1514–1424). I was backing down a slight grade with this engine 641, having hold of four loads and ten empties, going at about 6 miles an hour. When I approached a private crossing at the Champion Coated Paper Company at Hamilton, there was a truck which undertook to go over this private crossing. It was necessary for me to apply the brake in emergency. In addition to that, I reversed the engine. In reversing the engine in the forward motion, this power reverse gear lever started kicking. and it caused me to lose control of the throttle, as I had the throttle open. I was standing in an inclined position, making this emergency stop, and it was necessary for me to put my left hand out to catch myself, and in doing so I caught these two fingers between the throttle lever latch and the pin in the end of the throttle quadrant, mashing the nail off one finger and mashing the other finger so that it had to have a stitch put in it. That was on May 20, 1929. I did not lose any time, just long enough to go to the doctor of this company, and he dressed my finger, and I came back and went to work. The power reverse lever would take those spells of jiggering and kicking, and it was impossible to take hold of it without hurting your hand at times, and usually when it would get those spells, I would use my foot to get it down in the corner, and it would quiet down. There is quite a bit of force to the kicking of those levers. I could not say how much. After
401 you once get your hands on them, you are all right. When you change the position of the valve, it quiets down.

"Q. Have you at any time observed the actual valve gear, when the engines equipped with power reverse gears were at the terminals, before taken out for service, standing there, I mean, when the air was being pumped up?

"A. No more than just looking around the engine."

As to whether I have observed anything about the action of those engines equipped with the power reverse gears under those circumstances, with respect as to whether the valve gear moved or not while the engine was being pumped up: I have never noticed it except on these two, the 641 and the 1072. I have observed none of those conditions on any other engines equipped with power reverse gear than the 1072 and 641. On one occasion I was present when someone else was injured on an engine equipped with power reverse gear. On preparing to get up on the engine one morning—I cannot give you the date on that, but it has been about three years ago—the oiler was oiling the engine and the valve gear. He was standing up on the rod, the main rod, oiling the valve gear when the valve gear moved ahead. I seen him at the same time he hollered. I took it for granted that there was a man on the engine. I hollered to him, but he did not hear me, so that I made every effort I could to get up on the engine to reverse the engine, to let this man loose. I guess I am ahead of my story on that. When the engine was moved ahead, it caught the oiler's hand—and held him fast. The valve gear moved. The wheels did not turn. I hollered, trying to attract the man's attention upon the engine, and he apparently did not hear me, so that I got up on the engine and moved the reverse lever in the back motion, releasing the man's hand. This happened on the left side of the engine, and I was right alongside the engine when he got
402 caught. I mean I was on the lefthand side of the engine and he was on the lefthand side also. I did not see him, but from indications the reverse lever was moved by the man on the engine. This engine was equipped with Baker valve gear. I did not take time to look to see where his hand was caught, but it was somewhere in the valve gear. It developed into blood poisoning, and he was out of his head for three months, and he was laid up for a year, and almost died. He has not worked since. He was working as an oiler at that terminal at that time. (Examiner Rogers instructed Mr. Morehouse to look it up and see if the accident had been reported.) The man's name was Luke O'Neill. He told me that the last time I was talking to him at Hamilton. As to what has been my experience with the hand type of reverse gear as to whether or not I could maintain a fixed point of cut-off with my locomotive: I have never had any trouble with them, losing control of the cut-off on a hand reversed engine. As to my physical condition, that is, with respect to how I feel when I am operating an engine equipped with hand reverse as compared with an engine equipped with power reverse gear: They never hurt me any. I have always felt all right after a day's work with one of them. On one occasion last winter the power reverse on the 1072 was giving me quite a bit of trouble, and I asked for engine no. 2537, which is an E–27DA type. It is a 2–8–0, weighing 163,500 pounds on drivers. That engine was equipped with hand reverse, Baker valve gear. I have never experienced any difficulty handling a hand reverse gear,

while I have with a power reverse gear. My opinion as to which of these two types of gear is safer: There is less parts on a hand reverse gear to get out of order. I have never seen anything about a hand-reverse gear hurt anyone.

403 CROSS-EXAMINATION

Since 1909, I have been working mostly in yard service. About a year altogether of my time, distributed over various dates, has been in transfer service. In handling manually reversed engines in yard service, on different engines I use different means of handling the lever. Some engines I can put it back and set it up, while on others it requires two hands. As to what position I take in the cab when I use two hands: There is a foot brace there. Sometimes I use that and sometimes I do not. I use the foot brace because it has become a habit. It is in order to distribute the strain, if there happened to be any, through the body. Sometimes there is a strain. The strain you get by handling a manual-reverse bar is the movement from backwards to forwards. As to what makes that strain: The movement in order to reverse the engine; there is more or less friction. That is, anywhere you have friction in the parts which you have to move, that makes the lever work harder. You have got friction of the parts of the lever in the fulcrum and the bearings which support the reach rod. I do not know that they sometimes bind. If the engine is properly maintained and oiled, there is very little friction in the link block. A new engine out of the shop is naturally harder to handle than one which has been run a while. If the counter-balance spring is out of adjustment, that makes the lever operate hard. I have had that experience only on one occasion, that I can recall, in 20 years; on all other occasions my counterbalance has been in good shape, so far as I know. I have had occasion to reverse the engine when I had steam in the valve chamber (T. 1524–1534). That does not happen frequently; I go days and even weeks without having anything of the sort. I don't ever stop my engine on street crossings, I do not recall of any. I have
404 never had that experience in 20 years. I do not recall having to stop my engine where there were men on the ground working around in front of the engine. I have had none of those experiences in 20 years. I cannot recall any time that I have stopped on the crossing with steam in the cylinders.

"Examiner ROGERS: I said, have you stopped on the crossing with or without steam.

The WITNESS: Yes, sir."

When you come up to make the stop, sometimes you have steam in the cylinders. When you do have steam in the cylinders, you have got to reverse the engine with the steam there, and I have accomplished that. When I am doing the operation of reversing the engine with steam in the cylinders, sometimes I brace myself, put my foot on the foot brace, or any other part of the cab or boiler. I do that on

different engines to make it easier on myself. That is because I would need more strength than I would have if I did not brace myself. It requires more strength to reverse an engine if it is full of steam than if it has the steam out. With the power reverse, I have braced myself to reverse the engine when they pull, jerk, jam and rattle the gear, to get the engine over. That was the E type Alco on engine no. 1072. That is an 0–8–0. There was no other type on which I had to do that. That has been about a year ago. I made a report of it. I reported the condition, saying the engine would not reverse. That was a written report made to E. M. McCafferty, Hamilton, Ohio. There were several reports of the same nature made out on that. As to whether the condition was overcome then, when I reported it: I did not get the engine for about two weeks, and it was corrected. There were several reports made out covering that condition; this one time I had this engine for three days and I reported it three times. I have not had that trouble since, that same gear. I last had this engine on June 3rd of this year. It still has the E type of Alco. As to how many times you have to
405 operate the manual lever in the course of an hour in flat switching: The last test I made was in January or February, in weighing pig iron out of the Hamilton Coke & Iron Works, and we weighed 16 cars in 14 minutes. Ordinarily, under ordinary conditions, why, that would be a double move for each car weighed. I reversed the engine twice for each car, you have got to move away from the car. Under ordinary conditions that would mean that I reversed it 32 times in 14 minutes, but this service I am working in at the present time, however, I have weighed ten cars and moved ten times without reversing the engine. That is with either one, the power reverse or hand reverse; I have done it with both; sometimes we have a manual bar and sometimes a power reverse bar.

"Q. Now when you say you have never had any trouble handling the manual reverse, you mean by that that you have never been injured by it?

"A. No, sir.

"Q. You do not mean that you have never had to pull on it with sufficient strength to feel the strain or pull on you, do you?

"A. No, sir; I never have."

Even with steam in the cylinders, I do not feel any pull on the muscles of my arm or abdomen, nothing that hurt me. I never had a tired back from handling the lever over a day's work. I have handled that manual lever at the rate of 32 times in 14 minutes, and not felt any effect on my physical condition from doing that; never have felt no effect. I am able to go home and do work about my property, make improvements and do carpenter work at the end of a day's run. My work in the yard is not steady work, so that I am constantly engaged in throwing over the lever, say, once every minute or two. The yard covers quite a bit of territory, and there are long moves and long space between the platform or location to the other point where cars would be placed or

406 taken out. It takes me from one to three or four minutes to make a movement from one platform to another. As to when I reach a given platform, how many movements of the reverse bar will I have to make in performing the operation I have there: The movements vary. There is nothing set about it. This industrial work, you cannot specify anything definite as to the moves on this particular job. That is, I work all day, going from one shed to another and at each shed I may have two or three cars or more to set out.

"Q. Now, would you say that you feel just as fresh at the end of a day of that sort of work, when you are handling the manually operated reverse bar as you do with the power reverse?

"A. Sometimes I do not and sometimes I do."

Oftentimes I have had days when I have had the power reverse that I felt sorer and stiffer than when I had a hand reverse; the exercise you get from a hand reverse is beneficial, the movement you get compared with sitting there humped up, without any exercise in moving the power reverse. I have had that experience. In some cases, the operation of the manual reverse bar simply serves as an exercise for keeping in good shape. I am not saying all of the, but in some cases.

In yard service I am not working the engine with the lever in the corner practically all of the time. You do not do much hooking up in making a movement from one shed to another, not on short moves. I have not had much experience in hooking up or dropping down an engine at high speed.

In this one year and a half period that I had trouble with engine 641, I never could begin to count how many times I reported the Alco E type reverse gear. I could not count all the written reports that I would make at the end of the day's work. There are too many to count. I worked on an average on this particular job
407 of 300 days a year. It is a six day a week job. This trouble which I experienced was practically a daily trouble, for a long while. I reported it at the end of each day most of the time. I could not say whether I reported it as many as 200 times in one year. I do not know. As to why I cannot say; if I reported it nearly every day, it would be a rough estimate. You see this engine was put in the shop and worked on quite a number of times for this particular defect, and she would come out, and maybe she would operate good a month, or maybe she would go for three months before starting to creep again, and then the trouble would start. When I would have that experience I would report it, and then they would try to take care of it. When I would get it back it would go a month satisfactorily, and sometimes it would go longer. On occasions when I say the pipe outside the air-reverse cylinder froze, that was the supply pipe to the power reverse from the main reservoir. None of the other air pipes froze on that engine at the same time. They all come from the same place. As to whether the one that leads to the air-reverse cylinder is closer to the boiler, where

there is heat, than the one which goes to the brake valve, it is not close enough to retain any heat from the boiler. The one which goes to the brake valve is several feet to the one which froze up. Of course, there is a difference in the distance. They are both outside the cab, yet one froze and the other did not. There was not anything about the power-reverse lever that would injure you when it froze up; you could not move it (T. 1534–1545).

I am 49 years old. This property I spoke of is in Glendale, Ohio, 15 miles north of Cincinnati; nine miles from where I am working. I drive an automobile from my work to the property. I worked eight hours a day on the railroad. When I was working on my property sometimes I ran a little over eight hours at that time.

[File endorsement omitted.]

408 Of course, we do not make overtime there now and have not made any for a year. At that time I was on regular assignment; my hours varied, but never more than 8 hours, from 7 a.m. to 3 p.m. As to how far I live from the point where I was working; I would get my engine out of the roundhouse, which is 9 miles from my home. The distance we traveled over that belt line is approximately 7 miles. At the end of that distance that was where most of the time was put in. It would take me 20 to 30 minutes to go from my home to the point where I get my engine. It would depend upon the way I felt like driving. It usually took longer to go from where I left my engine back home. It took me 30 and 45 minutes to get home after I left my engine. This property and my home are the same. That is, I was improving my home. I live on the property that I was improving. To improve the property, the first year I built a barn; the second year, 1922, I built several chicken houses; in 1924 and 1925 I remodeled the house. I did all the carpenter work myself. It is a frame house, a story and a half, 11 rooms in all, 7 downstairs. At that time I was using a locomotive which was equipped with a manual reverse gear in the Hamilton Belt service. That was both transfer and switching service. We would do quite a bit of switching; that would necessitate a good deal of operation of the manual reverse. In reversing the engine sometimes I would handle the bar with one hand; sometimes I would do it with two.

"Q. On what occasions would you use two hands?

"A. Well, it would depend upon just the position I would be standing in or sitting in. I could either sit down or stand up. If I felt I wanted to brace myself and throw her over with two hands, I would do it. If I felt I wanted to throw her over with one hand, I would do it. This was a small type of engine and easy to handle."

409 I could always do that sitting down with one hand if I wanted to. I don't recall that there were any conditions that made it necessary for me to use two hands. I don't recall any time reversing with steam in the cylinders. Of course, if there was steam

in the cylinders I would use two hands. In the ordinary switching service you could always dispose of the steam as a general rule. You see, before you stop or attempt to stop you shut off the throttle. With an engine with a 60-inch driver you would move about 15 feet. In those 15 feet there would be four exhausts, thereby releasing any steam that may be retained in the cylinders. Therefore, I cannot say whether there would be any steam left in the cylinders. If I did it would only be a matter of guessing. I have no recollection of there being enough steam in there to interfere with my reversing with one hand.

I have worked in the same class of service with a power reverse gear, the Alco type E. On these two types of engines that I have been talking about, it would require a certain amount of effort to use the manual reverse than the power reverse lever, if the power reverse is in first-class shape. In the service in which I have used the power reverse I could operate the reversing mechanism at all times while I was seated. On some engines you could operate the manual reverse bar at all times seated. I have not had any engines with the power reverse that I could not operate seated. It was in yard service that I was so tired using the power reverse. This time I have reference to (what) happened in the latter part of last year. I cannot give you the day or the week. It was either along in October or November, or some time along in there. You would not always be more tired after a day's work with the power reverse than after a day's work with the hand reverse. As to whether it is physically more tiring to operate the power reverse than it is to operate the manual reverse: It is a kind of a fifty-fifty proposition. Some
410 engines with manual power handle easier than others. If you take a new engine out of the shop it is stiff and it takes time to break it in and you could not expect it to handle as easy as one that has been out of the shop several months. When you get one of those out of the shop like that sometimes you can operate it with one hand seated on the seat box; sometimes you cannot. Over on our division most of our engines that go into the shop on class repairs are done at Mt. Clare. It is about 600 miles over there and as a general rule they are in pretty good shape when we get them. I have had experience with dry valves very often. That has effect upon the working of the manual reverse lever; and on the slide valve type more so than the piston valve. It produces a friction and it washes the lubrication off of the valves. But if I would have such a thing as that I would consider it my own neglect. If I were neglectful and had a dry valve, it would naturally make the operation of the manual lever work hard. If my engine was in motion and I had a dry valve it would cause a pull on the lever. Under those circumstances if I thought there was any risk of the lever pulling out of my hand I would not attempt to hook the lever up in the yard service. I have never had one to pull out of my hand (T. 1545–1556).

I have never had an occasion when I would not attempt to handle the lever. As to how I know there would be a pull on the lever if

I had dry valves: There is more or less chatter to the lever. Of course, I have never had very much experience in that way with dry valves, but I think it would be more or less warning due to the chatter of the latch handle. As to how I know it would: There is a certain amount of lost motion in all valve latch handles, and any vibration or rattle. To a certain extent I am just guessing that a dry valve would make a pull on the lever.

I belong to the Brotherhood of Firemen, Lima Lodge, located at Lima, Ohio. I just forget what the number of the lodge is now.

411 On one occasion I asked to be taken off an engine that had a power reverse and to be given an engine with a manual reverse. The power reverse had a defect in it that made it so hard to reverse that you didn't know half of the time whether you would get it over or not. You would have to rattle the valve and jerk on it and push, and on some occasions I had to move the engine in the direction in which it was standing to get the valve to move in order to reverse the engine. That was type E of the Alco, on engine no. 1072. The reversing mechanism was out of order.

"Q. (By Examiner Rogers). Was that the occasion where you said you had reported it?

"A. Three times.

"Q. The days?

"A. Yes, sir.

"Q. Before that time?

"A. Yes, sir; it is the same."

That is not the engine that I reported a number of times. I reported this engine three times for only that one defect.

"Q. Was there some engine or were there some engines that you stated you reported regularly?

"A. Yes, sir.

"Q. What engines were those? Do you recall them?

"A. That was the L–2. It was an 0–8–0, engine no. 641, equipped with the E type Alco valve gear."

I stated yesterday I was unable to give you the number of times that I reported it; quite a number of times. I remember very plainly I said I reported it almost daily. There were times when it was not necessary for me to make out a report because on this trick I was on, there were three crews that handled the engine. One

412 crew relieves me and the second crew was relieved by the third crew, and so forth. And at the time the engine was in the house having repairs made on it was not necessary for anyone to make a report on that engine. I believe that covers the statement I gave you yesterday. I cannot say the exact month I reported it, but it was around 1928 and about a half of 1929, as nearly as I can recall.

I cannot say that I ever had a power reverse that was in perfect condition. As to whether I ever had one that would stay where I put it. Not all of the time. You see the air on each side of the piston forms a kind of a cushion and in order to put enough air in

that cylinder to hold that piston so that it would not vibrate it requires such an enormous pressure that in reversing the engine it will go down in a jam and cause more damage. Well, I will not say what damage it will be, but it would go down with an awful shock. That is my theory of it. I never have run an engine with a power reverse gear on it that would stay where I put it. By the valve gear pumping on an engine I mean the traveling of the air piston in the power reverse, reversing back and forth with a variation of an inch on each side. With a travel of two inches that would make a variation of an inch on each side of the center, and it would produce what we call a pumping motion. It would move quite a bit. If we would be working a short cut-off it would cut it out sometimes. At some times we make a practice of working with a short cut-off in switching service, not so often. Where I had the main trouble with this one particular gear was out of Hamilton, where we have a hill of about three miles or three and a half miles long and they give us heavy cuts out of there, and it is necessary to get a run at this hill, and in order to get a run at it you have to hook up your engine, shorten the cut-off. As the speed picks up you shorten your cut-off. That is the transfer belt service. I did not make a point of working a short cut-off in switching service,
413 not when switching cars or kicking cars. With my engine where I usually operate it in switching service, it did not affect the cut-off to amount to anything, except the jiggering and the pumping of that gear would cause the handle to kick and jump, that is, the reverse lever handle to kick and jump, and at times you could not take hold of it without losing your hand. There is not directly a connection between the reverse gear and the piston. It is connected but it is not hooked up just the same. The pumping of the piston causes it to jump and jerk. Defects in the valve—leaking, causes the piston to pump. If the valves and the packing in the reverse are in proper condition I don't think they jump. It could be possible that the same thing that happened to Mr. O'Neill, who got his hand caught in the power reverse gear, might happen with the hand reverse gear if somebody dropped the lever down. With either kind of valve if a man got his hand under the reach rod or in the links and the engine was moved or the lever moved he would get his hand caught; it would be possible. But there would not be so much force behind it with the hand reverse as with the power reverse. With the power reverse it might be turned by the engine itself; and no one knows how much power there is behind it. As to whether there is enough power in the hand reverse to cut your fingers off if they get behind the reach rod: I wouldn't like to have mine in there.

REDIRECT EXAMINATION

In a situation of that kind, where a man gets his hands in the way of the moving parts, the hand reverse moves slower than the power reverse; the slower movement of the reverse gear would give a man

more of a warning that the gear was being moved. In some cases it takes longer to reverse an engine with hand reverse than it does with power reverse. It depends upon how fast you want to reverse with the power reverse. You can reverse the hand reverse faster if you want to than you can a power lever, that is, with the
414 power reverse there is a set speed and you can reverse just so fast and no faster. There are hardly any two of them alike, according to my experience. With the hand reverse you can reverse it slower, and if you wanted to you could reverse it faster, that is, on most engines. As to whether there is anything else in my mind as to the characteristics of the two types of devices, the hand and the power, that would have any bearing upon the ability of a man to get his hand out of the way of moving parts under those circumstances: There are less moving parts on a hand reverse than there are on a power reverse. The power reverse type E has 46 parts, and type G has 54 parts, and type A of the Ragonett has 63 parts. Mr. O'Neill's hand got caught in the valve gear of the Baker valve on that side. I just couldn't tell you between what (T. 1556–1567). The number of parts of the power reverse did not have anything to do with that. We have the same gear operated by hand. The fact that the hand lever on the manually operated reverse engine connected through the reach rod and tumbling shaft to the Baker valve gear part, whereas on the power type of gear the operating lever is not so directly connected that would have bearing, in my judgment, upon the ability of the man under those circumstances to get his hand in the clear of any moving parts. If he happened to get the engine without any air on it, if he was starting up the air pump, as the air pressure is pumped up the gear will move, and if you happen to be down, working around the parts or if anyone would be down working around the parts he would be liable to be—It is possible for him to get his hands in the parts if he was not expecting it and if the gear was moved by itself. I would say it is less difficult to keep away from the moving parts of a hand-operated engine than it is a power-reversed engine. I have in mind the valve gear that it is easier to keep away from. With reference to the pumping which I described for counsel, I meant the power reverse piston when I mentioned that there was a
415 traveling of the piston, in the air cylinder of the power reverse. I mentioned in connection with reporting on this one locomotive with which I have had so much trouble creeping, the 641, that it was not necessary to report it if they were working on it in the shop. As to just what I had in mind in that connection: About twice a month or every fifteen days they lay the engine up for repairs. That applies to all engines. On one-half they will change the water and make repairs, or what we call hot work. The other period is when they wash the boiler out. They usually use several days, that is, over there at Hamilton, and that is the time I mean that we are not required to report. The engine is laid in for the purpose of doing the work that has been reported. During

the time when I am running the engines every day they run in three tricks. In the summer of 1925 I lost 30 days in the entire summer at different times, that is, three or four days at a stretch. That was the only time I laid off. During that period of 1920 to 1925, I worked more than my regular 8-hour trick a day on the hand-operated engine. I could not recall to what extent I worked more than 8 hours. This was an industry job, and some days we would not get the work done and would have to stay there until we got through. Some days it would be 20 minutes and maybe some days 40 minutes and maybe some days an hour, and then we would go along for days at a time and we would not make any overtime. I would not say definitely about. I remember one we got the dog law. As to how much of the time the valves and packing on these engines that pumped have been in such conditions as to hold the gear at a firm or fixed point: On the 641 it was a period of a year and a half on that engine. During that period of a year and a half if the valve and packing of this power reverse gear cylinder were in a hundred percent condition the pumping would not occur in the gear. I said that I never ran a power reverse gear that would stay put.

416 RECROSS-EXAMINATION

When the manual reverse mechanism began to move a man has more of a warning. The manual reverse would move slower than a power reverse as a general rule.

"Q. That would not be any warning if a man did not see it, would it?

"A. Yes; he would have more of a chance to get out of the way."

You would have more of a chance to get out of the way of an automobile going two miles an hour than you would to get out of the way of one going 25 miles an hour. That is not about the ratio of the movement between the hand reverse and the power reverse. As to why I used the illustration that the hand reverse moves to a power reverse like a two-mile automobile to a 25-mile automobile: If you wanted to move it that way it would. If you want to move it faster you can move it faster. It is the man in the engine who is operating this manual reverse, absolutely. The movement of the gear is the warning given to the man on the ground when the man on the engine starts to move the manual reverse. That is all there is. If a man on the engine is going to move the engine he will ring the bell. As to whether with the power reverse if it took a notion to start moving there would be nobody there to ring the bell: We have safey rules and we are required to live up to these safety rules. If it is a manual reverse and the engineer is going to move he will ring the bell; if he has a power reverse and is going to move the engine he will ring the bell just the same. I did not say that he did not ring the bell. I said if the power reverse should happen to creep or move on its own accord there would be nobody there to ring the bell.

The creeping of the power reverse would start the valve gear. It would not start the engine, not unless there was somebody there to give it steam. I never said anything about the engine moving. We were talking about the valve gear moving.

417 "Examiner ROGERS. I take it what the witness is talking about is when the air is first pumped up that the gear moves up to the position that the power reverse lever is set of its own accord whereas that does not occur with the hand lever. That is as I got it."

As to whether if the power reverse mechanism moves of its own accord in that manner will it move faster than a hand reverse mechanism will, if the man in the engine is reversing the engine: I have seen it move slowly and I have seen it move fast. My opinion is that the position the engine is standing is the way the gear moves.

In the case that I described about engineman O'Neill, I don't know that the engineman moved the reverse lever at that time. I wasn't on the engine. I was walking towards the engine on the left side and the man on the engine was on the right side. I cannot say what position he was in because I did not see him. In that case it was a power reverse lever; there was a man on the engine. I don't remember saying that the man on the engine moved the lever. I did say that the valve gear moved. I did not say that he moved it, because I couldn't see him (T. 1567–1577).

I told you yesterday that from indications somebody reversed the engine. I still stay by that. But he asked me if I had seen him move it, and I said no, I didn't see him.

When the engineman moves the power reverse there is a warning, the exhaust. There is no similar warning with the manual reverse if the engineman moves it. With the manual reverse the only warning is the movement but with the power reverse there is the warning of both the movement and the exhaust.

The rules of the company for which I work require me to make out a work report once in 24 hours. That is, in switch service. In road service they require the engineman to make a report at the end of each trip.

418 REDIRECT EXAMINATION

I don't think the valve gear moves before the exhaust from the power reverse can be heard. With the hand type of lever the valve parts begin to move as soon as you move the lever in the cab. With the power type of reverse gear the valve parts do not begin to move as soon as you move the operating lever in the cab.

R. C. SCHRAFFENGER, locomotive fireman for the B. & O., 32 years old and weighing about 146 pounds, testified:

I began working for the B. & O. in May 1923. As to whether I have been promoted to run an engine: I am through with everything but machinery, and I am ready to take that. I am about to take it. As a fireman I have had quite a bit of experience in running the

locomotive in place of the engineer. I hold straight seniority on the Toledo Division but most of my work, or the biggest percent of my word, has been in the yard, mostly in Hamilton Terminal. I have fired for Mr. Brotherton possibly something between 3 or 4 years, I expect, that is, off and on at different times. That is intermittent. I don't think I fired for him any time prior to 1925. I fired in yard and road service, transfer and belt. I have operated both types of engines, hand and power. As to which I operated the most: As nearly as I can judge, about fifty-fifty. I heard the descriptions of the different types of engines which Mr. Brotherton had operated, when he was testifying here. As to whether or not the same types of engines are the ones which I have fired: Some of those smaller ones I don't believe I ever fired. I think about as small an engine as I ever fired was the 200 class. That was when I first commenced to work for the B. & O. I think that is around 100,000 pounds on drivers. I don't know just exactly what the weight is. With that exception I have fired and run the different classes of engines
419 which Mr. Brotherton mentions, and the biggest part of it in that same territory. I have had some road service outside of that territory; that was through-freight, pool, between Ivorydale and Lima, a distance of 125 miles. The first regular pool I had was in the summer of 1929. Then when I was on the extra board—when I first fired with the company, I worked extra between those points, first in and first out on the extra board.

In operating the hand lever on these B. & O. locomotives I have seen engines jump out of the quadrant. I cannot state when, but I think it was in 1928, I was on a pit job that had an engine that jumped out of the quadrant. The front end of the quadrant was low. We reported it and it was corrected. That is the only time I can recall. I never saw a lever go to the corner with a bang. The latch would jump and, naturally, it would catch as it went on down. I never saw one go down with a bang. I have seen them crawl down. I have not seen them crawl down on other than this one occasion; I am talking about this one occasion about the reverse lever catching, and I cannot state positive it went all of the way to the corner. I can't say I have ever had any experience with hand levers pulling away from me. I had about 40 percent of my time running the engine. As to whether they allow the firemen to handle the engines on the B. & O.: I think that is up to the different road foremen. I imagine it is, because the road foreman on this road, when I was running the engine, has never complained and never said anything about it, and I have run the engine a good deal when the road foreman has ridden with me.

I have never been injured by the hand lever or the operation of the hand lever in any way, nor have I ever observed anyone being injured in that way. I cannot say that I have a customary position in handling the reverse lever. Sometimes I will handle a hand lever with my arm on the rest, that is, on the arm rest. At
420 other times I might take two hands to handle it. I have

always been able to handle the hand lever on any engine that they ever had. The handling of it has in no way interfered with my keeping a look-out. We had the screw type of hand operated gear on the 6100's but I never operated the 6100's outside of—well, those are all road engines—moving the engines, or something like that. I mean I never pulled the train over the road with it. I have only operated those around terminals or if the engineer was in at lunch and they wanted the engine moved for some reason. I never pulled a train, that is, over the road. I have experienced no difficulty in reversing the engine with the screw type of hand gear. I have seen power reverse gears creep and I have seen them do what you would call pump, that is, I have seen one pump. That is the only one I ever saw pump. I have observed them creeping until the exhaust would get weak if they were coming up towards center. If they were going the other way the exhaust would get very loud. This has occurred quite frequently. In my handling of the hand reverse I have never found any conditions rendering them dangerous so far as my person was concerned in handling them (T. 1577–1589).

As to the comparative efficiency of the hand lever as compared with the power reverse gear in the movement of trains over the road: If the hand reverse is hooked up and you get your cut-off you get the same cut-off as long as you want it. You have to have an engine hooked up to make speed, and the further an engine is towards the corner the more coal she burns and the more water she uses. With the power reverse that creeps it would possibly be in the corner part of the time and possibly it would be nearly cut out part of the time. I never did see them clearly cut out. As to what effect the creeping of the power reverse gear has upon the operation of the locomotive on the consumption of fuel and water: When it goes down towards the corner it burns more coal and it uses more water; you can't make the speed. That is the place you have to start the
421 train, and to make your speed you must get rid of your steam that goes through the exhaust as soon as possible. You want to get rid of your steam, and the shorter valve travel does that. I couldn't say just how much more coal and water the engine will burn when she creeps, but I know it takes quite a bit more. I have known it from firing. When that 641 is creeping then we run for the hill, we had to leave that engine in the corner and I had to stay in the deck. If she was not, I could go to the window once in a while. That is the difference. Of course, I don't know how much difference there was in the coal we used. You couldn't shut your injector off either when she was down in the corner. I have no idea in the way of percentage how it affects coal consumption. I can't say that. And all I can say is that an engine in the corner, when you have to use it, and you have your injector on, she burns just about all of the coal you put in, that is, the 641. And if you hook it up and get a run for the hill perhaps before they get over the hill you would have to cut the injector down and not put so much water

in it, and I could go to the window then. I would not have to stay there and shovel coal constantly going over the hill. Constantly and fast, too, I have done it on the 641. With an engine equipped with the hand lever I have had experience coming up over that same hill. I didn't shovel the coal. I always fired just about going over the hill, not always, but just about always. My experience with hand-equipped engines in going over that same hill as to whether or not they kept hooked up: If they get a run, if it is possible—and, of course, it is not always possible to get a run; a lot of times the switches were high-balled and we could get a run and they could hook the engine up, and then as we got to the hard part of the hill they could let her down a notch or two at a time and it would save me quite a bit of work. As to the other engines I had that were the same size as this no. 641: We had the 2500 and they have a 2800 once in a while over in here. You see, this belt engine is not
422 the only one that goes over there. Any engine on the terminal goes over the belt, that is, that they see fit to send over there. They have only one engine the same size as this 641 in that terminal.

"By Mr. MOREHOUSE:

"Q. Explain what hand reverse gear equipped engines you have used over that hill that you make a comparison with this 641?

"A. 2500's and 2800's. The 2500 would be the best engine to compare with it. I think they are near the size of the 600's."

Their tractive effort compared with the 641 is not as much. I don't know how much difference there is, though. On any of those engines, equipped with the hand lever there has been no failure to maintain the desired point of cut-off, with the exception of this one case where the lever jumped out a few notches at a time.

I would consider the hand reverse safer than the power in this way, that if I was oiling the engine around I would use more caution with the power reverse. You can't stand on the ground and oil an engine; you have to get up on the rod and hold on to something. And I would use more caution with the power reverse than I would with the hand reverse. There is no other distinguishing feature between the two that I have in mind in that respect. The only thing I would have in mind would be that a power reverse might creep and the other would not, if that is what you mean.

CROSS-EXAMINATION

I have not been promoted. I guess 75 percent of my experience since I hired as a fireman has been in yard service.

I was on the engine at the time Mr. Brotherton injured his hand and I observed that accident.

The weights on drivers on the engines that I have reversed in yard service were from around 100,000 pounds to 220,000 pounds. I would do that for the engineer. He has not asked me at times to assist him in handling the lever.

423 I have had engineers rather old. I cannot say as to their age. They were gray-haired men. On these 200,000-pound engines every man I ever fired for was always able to get the engine over. I cannot recall any time a man has ever asked me to help throw the reverse lever over. I have not helped him. I have been standing over there and throw it over for him, because I was standing there and maybe I was in the way or something and talking to him and he would say, "We are going to back up", or "We are going to go ahead", and I would take it and throw it over. I would have no thought at all in mind when doing that. I would just do it.

I would say some of those engineers in handling the lever use a foot brace and some of them do not. I never paid a great deal of attention to a man throwing an engine over or reversing an engine. Of course, I have seen them. I have seen it thousands of times, I guess. But when I am reversing an engine I have my way of reversing it, and maybe another man has a different way. I don't pay a great deal of attention to that. As to the engines I have handled since I have been with the company, I cannot say that the foot brace is absolutely necessary for me. I can't say that it is necessary at all for me, although I don't say that I have never used it. When I have an engine with steam in the cylinders and want to reverse it I can do it without using the foot brace, but that is a very rare occasion, to stop with an engine with steam in the cylinders. About the only time you would ever have experience with that would be if you would miss a coupling. You do that. As to whether it happens quite frequently: Not a great deal; no. But when I say miss a coupling I mean where they didn't roll ahead. If they roll ahead sometimes you can give the engine—well, if I miss a coupling and want to go ahead, if the cars roll ahead a little bit, I will give the engine just a little bit of steam and weight and let her go and let her make up to a coupling and go in. It may be a little
424 slower. But I wouldn't pull the throttle half way out. I never try to flood the cylinders full of steam in making a grade, every two exhausts of the engine—or every revolution of the engine there are two exhaust on one side, and that will clean out the cylinders. That applies to every kind of engine (T. 1589–1598). When you are making couplings you can miss one more than once; it is possible. The men on the ground don't ask you to hurry. I have never been asked to hurry since I have been working for the company. I never heard of anyone being asked to hurry. They don't ask you to hurry, that is, our company doesn't.

In yard service I operated the engines about 40 percent of the time as engineer. As to why I say that: You know the firemen of today are the engineers of tomorrow, and I want to. I don't ask to do it; I never asked the engineer to handle the engine. The engineer has said, "Do you want to handle it?" or something like that, and I have always said "yes."

When I am running I have seen the hand-operated lever quiver in the quadrant and vibrate back and forth. It is caused by loose

connections. I mean worn parts or worn connections. It would be the wear in their valve gear, the whole valve gear or any part of it. Or probably the movement of the valve in the steam chest caused it to quiver. Each movement of the valves is reflected back in the lever. You feel a little vibration. That is all I know. If you have hold of the lever and lift the latch out you will feel those pulsations of the valves and the vibration of the parts; you could feel them. If the lever is hooked up pretty well towards center and you are going in forward motion it has some tendency to pull the bar forward. I never have had an engine to pull me off my balance. If a valve ring should break or if there should be any disturbance in the valves so that you would get a jerk, that would be com-
425 municated to you if you had hold of the lever. I consider a lever safe that can act in that way. I would not consider a manual lever safe if men were pulled off of their seat and hurt by it. The only thing I had in mind when I said the manual reverse was safer than the power reverse was the matter of getting caught when you are oiling around. And then I also said that power reverse might creep. I have never been injured myself by the power reverse gear creeping. I saw Mr. Brotherton hurt; well, that wasn't creeping. That was pumping when he was hurt. When the power reverse lever creeps the hand lever in the cab remains stationary, so that there is no danger of being hurt from that.

"By Mr. McLAUGHLIN:

"Q. Were you speaking about the working of the engines going up a hill with respect to the amount of cut-off you would use with a manually operated engine and the power-reversed engine? When the power reverse creeps under those circumstances the motion goes down into the corner or towards the corner and then it comes back, doesn't it, Mr. Schraffenger?

"A. It might go either way and it might keep moving."

I believe it would go either way just about as much, or it would go one way just about as much as it would another. I would think it would travel back towards the center as often as it would travel down towards the corner. When it is traveling back towards the center, it is using less steam and water, because there is a shorter cut-off.

"Q. So in fact there would be a tendency to balance the occasions when you used more and when you used less steam and water?

"A. Well, an engineer can't run very far that way. He has to put it down into the corner. He can't let it work back and forth.

"Q. But if the number of times were about the same there would be a balance, wouldn't there?

"A. Well, he can't do that. If you are running for a hill you lose your speed and you lose your power when she comes to-
426 wards the center, that is, when she goes further than you want it, and you can't play with it there. You would have to put it down in the corner and leave it there if you are going to make the hill. There may be something behind you and you may have to get over the hill to keep from having a delay."

I have not any record of the amount of coal that I consumed over these trips. We never keep a record, that is, the enginemen do not. I guess they do at the roundhouse. They might, but I can't say. I have never paid a great deal of attention to the amount of coal that was left in the tank after a trip with one of the power-reversed engines as compared with one of the manual-reversed engines, but I do know with the power-reverse gear that is creeping or has to be left in the corner that I shovel a great deal more coal. I can't say how much coal I would shovel.

I don't believe there is much difference in the area of the fireboxes of this engine no. 641 and one of the 2500 class. I don't know the areas of these two fireboxes. I don't believe there is much difference in the areas of them. They are both superheated. The weight on drivers on the 600s is about 220,000 or 223,000, or something like that. I think the 600 is a converted 2500. The 2500 has pony trucks and no engine trucks. It is not a new engine. The 600 is a converted 2500, with no pony trucks and no engine trucks. I believe the tractive effort of the 641 is 57,000 or fifty some thousand. I think the 2500 class are 40,800. It may not be just exactly what it is but I think it is around that. They publish these tractive efforts; the company has books on it.

If the power reverse is maintained so that it does not creep I haven't had any difficulty in hooking it up or dropping down the engine and maintaining the proper amount of cut-off. In the yard you find most of the time that a power-reverse lever will operate the engine successfully if there is steam in the cylinders
427 or if the parts are binding. We had one power reverse, which might have overtraveled—I can't say what was the matter with her—at one time, and I got on the ground with the shaker bar. It had the Baker valve gear. And I got under the frame to help reverse the engine. That was not on account of the binding in the Baker valve; it was something in the reverse gear, to the best of my knowledge. I can't say just exactly what was the matter with it. It was probably reported by the engineers; I don't make reports. It was only on one or two occasions that I had that happen. The other one was on the same engine.

In going up this hill you did not always have to throw it down into the corner with the power reverse. I will say quite a bit over 50 percent of the time you would do that.

"Q. Both when you were firing it and when you were running it over 50 percent of the time?

"A. If it was creeping. They always had to when it was creeping."

In my experience in going up this hill I will say 50 or 75 percent of the time I would have to put the power reverse into the corner to go up. As to how much of the time I would work with the hand lever in the corner: Only to start our train, and when we got pretty nearly to the top of the hill if the speed was cut down so that we thought the train might stall we would keep putting the hand lever

down until maybe possibly when we got up to Belt Junction switch we would have it nearly all of the way in the corner, because we would have to stop and we would have to slow down and sometimes stop to get the switch, and we would have to start the train there anyway. Absolutely it would be that with the power reverse that before you started up the hill you had to put it in the corner. You could have taken a run for that hill with the power reverse;
428 you would take the run for the hill with it in the corner. I don't know how fast we would run our engine with the power reverse in the corner, maybe between 15 and 20 miles an hour, maybe possibly not 20 miles an hour. As to whether that is the speed you are going at when you are running for the hill: You are getting as much of a run as you can. That is about as fast as you can go, I imagine, between 15 and 20 miles an hour. You could possibly get more speed with the manual reverse. Maybe we would get up, possibly before we hit the worst part of the hill, to 25 miles an hour. It is from a level to the hill. It is not down one hill and up another; it is from the level to the hill. In my judgment, it would be about 25 miles an hour. You would possibly let your speed get down to possibly 12 miles an hour before you would begin to let your manual lever down a notch. Of course, if the valves were not square—it is owing a great deal to the sound of the exhaust, but you get used to it. Some engineers will let it down sooner than others. I don't believe I ever did have any two engineers work just exactly alike on that hill. I can't recall any instance just now of ever seeing an engineer let the lever down when he was going as fast as 12 miles an hour (T. 1598–1612). The engines which I just described were hand fired. The rules of our company require at places that a man take the signal from the left side where it is impossible to get them from the right. The rules of our company require us to be on the left side of our engine on the seat box at all times when we can when the engine is moving or about to move; they expect you to keep a lookout on your side of the engine. I didn't say I was over alongside of the engineer reversing the engine when the engine was moving. I said when the engine was standing still, and he would say, "We are going to back up" or "We are going to go ahead", and if
429 it was in the opposite direction I would throw it over. After I threw it over I would walk over to my seat box or put in a fire or do whatever work was necessary. I have oiled engines. It is not usual when we start out of the roundhouse, because the engineer wanted to inspect the engine at the same time while he was oiling her. But I have oiled engines in the yard. The engineers on our road do not permit the firemen to oil for them on all occasions, but on some. With this power reverse gear that I am discussing I have seen power reverse gears you could fix at the point of cut-off you desired and it would stay there. That would be in first class condition. It has to be in first class condition to stay where you put it. I have not known of any instance of men being pulled off of their seat by the hand lever.

WALTER PRICKETT, locomotive engineer on the B. & O., living at Connellsville, Pa., and 49 years old, testified:

I have been a locomotive engineer on the B. & O. since June 7, 1907. I worked as a fireman for the B. & O. from September 4, 1903, until June 7, 1907. Since 1907 I have been in regular service as an engineer on that railroad all but eight months, when I was set back firing because of depression in business in 1908. The biggest part of the time I have been operating mostly in through-freight service or pool service, unassigned freight service between Connellsville, Pa., and Cumberland, Md. I have had very little experience in passenger or switching service. I have operated locomotives ranging from about 111,000 to 466,300 pounds. The last mentioned is a Mallet. The weight of engines equipped with the hand-operated reverse lever that I have operated range from 111,000 to 220,000 pounds, or something like that. The Mallets are equipped with the power-reverse gears and the class S engines are equipped with the power reverse. The 4500 and the 220,000 are also equipped with the power reverse.

I have operated some of those classes with power reverse and
430 some with hand reverse. The largest power I have operated are the 6200 with the wheel reverse. It is a hand reverse. This is the screw reverse. There is nothing there but hand power. Some call it wheel reverse. I call it screw reverse. That is the same thing. This 6200 is the largest type of engine on the system I know of that is operated by hand reverse. I think the weight of it is 337,000, or something like that. It is a 2–10–2 wheel arrangement. That is a locomotive used regularly in freight service. That is the one I have been on practically since 1924. It has been mostly in our service. From about 1919 to 1924 I was assigned to the Mallet engines in the service in which I worked. Practically all of them were Mallet engines. My experience with the hand-lever type of reverse gear was mostly prior to 1919. As to my experience with the handling and operation of engines equipped with the hand type of reverse gears, either lever type or screw type: If the engine is properly equipped and with no defects and if the engine has been in service a while, I have never found it no hardship to handle the engine, or no exertion. I have never been injured in any way in operating those hand-gear engines. If an engine is just out of the shop, or something like that, you may experience a little trouble in reversing it. There has never been anything in that connection which has worked any hardship upon me. I have never found anything about the operation of either type of these hand gears that was dangerous to me as the operator of them in the cab. On practically all of the engines I have ever run with power reverse gear you are unable to maintain the proper cut-off with them on account of the reverse creeping, allowing the valves to travel too far, and unable to maintain the required speed of your train, and they are very hard on fuel and water. I have had a little difficulty in freezing weather with the reverse freezing up. It is necessary to thaw the cylinder out before you can reverse your engine. I have experienced

delays on different occasions with the trains for that reason.
431 I couldn't make any definite statement as to just how frequently the reverse freezes up. It will happen at any time when the weather is zero or below. It occurs on the line of road. I have had them freeze up when the train was going and found them froze up when I stopped. When I stopped, the brakeman cut me off for water, and when I went to reverse the engine to give the slack so as to lift the connecting lever I couldn't reverse the engine and it was necessary for me to thaw the cylinder out before I could reverse the engine, which consumed about 15 or 20 minutes' time to do it. I have seen the engines standing at the terminal when the air pressure was pumped up and the valve motion probably would raise up about four inches and then come back down. It would raise up and down. I don't know whether you call that pumping or what it is. I have observed that ever since the Mallet engines went into the service on the district in which I am working until we got the S–1 engines. We don't have very few of those engines in service. Probably once a month we run them in our service when we get short of engines. But it was all of the time from 1919 up to 1924 you could observe it most of the time. That was during the time I was working with the power reverse gears; with that class of engines. From the standpoint of safety under the present conditions of the two gears I would prefer the hand gear to the power reverse (T. 1612–1622).

As to whether I have anything else in mind besides the safety in making that statement: Nothing more than that you can obtain the positive control of your valves at all times with the hand gear. You can't obtain the positive control with the power gear.

CROSS-EXAMINATION

By Mr. McLaughlin:

"Q. Mr. Prickett, you said you had no difficulty in past years with manually operated reverses if the engines were properly equipped and there was no defect. If you did have something defective about the valve motion or the valves, then you do have trouble with the manual reverse, do you?

432 "A. I wouldn't say that I have more trouble. I might have to use a little bit more energy to handle the equipment."

I might have braced myself at times. It might not have been necessary. I braced myself because that was a form of habit. I might go out here and take a drink of water and reach over to turn the spigot on and I would absolutely protect myself in the move before I would do it. I probably would brace myself. I never made any particular performance of bracing myself on the engine. They do not have a foot brace on those engines that I can recall. They probably have some on the little engines around 111,000 pounds. They had most anything on them you want, but they haven't varied for about eight or ten years. As to whether those are the engines

I am talking about: And the bigger power I worked on, the 220,000 pounds, have had no foot brace on them. I can't answer for what the other engineers have done but I never wore any pipes smooth putting my feet on them and bracing myself. To the best of my knowledge I have never observed any engineers bracing themselves when I was firing. That has been quite a few years ago. Those engines were pretty small. They could handle the lever most any way they chose to—sit on the seat or handle them in any way they wanted to. It was small power. I never experienced any trouble with broken valve rings. As to whether I ever hand any strips to break off on a slide valve engine: They probably might have some broken. I wouldn't say positive whether they did or not. I couldn't say and be honest about it. To the best of my knowledge I never had any trouble in reversing slide-valve engines. As to what I mean by saying if the engines were properly equipped and there was no defect there would be no difficulty in reversing an engine: You have lots of defects on an engine. Most anything would cause an engine to reverse harder than it should. An engine improperly oiled by the engineer, for instance.

"Examiner ROGERS. What the witness said was that he had
433 always been able to handle them without hardship if they didn't have any defect."

As to what I mean by hardship: I guess that is what you mean when you want to put your foot up against the boiler head or something like that. I guess that is what you mean. That is what I meant when I said I didn't have no hardship. I didn't have to put my feet up against the boiler head or brake pipe or anything like that. I probably have put my feet up against the boiler head. When I make a trip I don't make no record of it at all. I forget it as soon as I can. I don't think I ever braced myself or anything like that, not necessarily. I don't think I necessarily had to. I don't know if I ever did it. I cannot say as to whether if the Mallet engines that I was running was equipped with the manual reverse I would think there would be anything dangerous about that lever. I never ran a Mallet engine equipped with a hand reverse. I cannot estimate to you the amount of weight that the manual lever has to move in the valve motion. I never operated an engine with double valve gear, and I don't know what the weight would be, and I don't know whether it would be possible to do it or not. On the Mallet engines the mechanism is considerably heavier than on one of these light engines that I was running a great many years ago. The manual lever has to move certain parts of the valve motion and the links.

"Q. Can't you tell us whether the larger links would be harder to move than the smaller ones?

"A. I would not be able to say the distance you move, and you have two sets of engines there, and whether it would be possible for a man to reverse a Mallet engine with the hand reverse or not I wouldn't be able to say. I have never had that experience."

When I told Mr. Morehouse a little while ago that I preferred the hand gear to the power gear from the viewpoint of safety, I was talking about engines that I could handle, engines with which I was familiar with that equipment. I doubt if it would be possible
434 to reverse a Mallet engine with a hand reverse. As to why I doubt that: Only the distance that the gears are from the cab. I suppose the weight of the parts would have something to do with it. Any of the engines that I have run with hand reverse I have never experienced any trouble with their pulling the bar out of my hand or anything like that. I suppose the relative amount of weight, the heavier weight you have to pull the harder it is to pull it (T. 1622–1632).

The harder I would pull on the lever the more strain it would put on me. There isn't a likelihood of my hurting myself; I am not going to pull that hard. I have never found any occasion to use that much energy. If I did have a lever that would be so hard to pull I could not get it over, I would ask for assistance. If the power reverse is properly maintained I have never found a time I could not reverse the engine. There is a question in my mind whether it can be properly maintained or not. I probably have had them where on a part of the trip they would not creep but the majority of them, to the best of my recollection, they would creep. I can't positively say that I have had an engine for the entire trip that did not creep. I can't positively say that I had an engine that did not creep. I can't give you any exact date as to when I ran a power-reverse engine last. Probably in the last 90 days I had a power-reversed engine. It crept on that occasion and I reported it on a written blank and left it in the usual place in the Cumberland work report office. It might have been around in the early part of May or it might have been along in the latter part of April that I reported it. The number of the locomotive was 7163.

"Q. Before that when was the last time you operated a power-reversed engine?

"A. No. 4522, I believe, was the last I can remember. We don't very often get those power-reversed engines."

That has been a good while ago. It was probably a year ago.
435 I can't just recall all of those engines. That one crept and I reported it to the road foreman of engines. I made a written report and reported it to the master mechanic at Cumberland. The engines assigned to my class of service are wheel-reversed engines. I have handled very few power-reversed engines. Probably once in a great while. I can't just make any definite statement as to the period of time. The men in my territory are not running power-reversed engines. With the power reverse that I had I was unable to maintain the speed of the train at certain times. That would depend upon the condition of the grade and the tonnage you have in your train to what extent you would lose speed. If you lose 10 or 15 minutes between telegraph offices on running time the

company might ask you what was the matter. I don't know if I ever lost that much time because of the air reverse. I probably have and probably have not. I was never called in for losing speed, not exactly. I have lost time by pressure to the extent that I have been asked about it a lot of times by my road foreman, Mr. Browning. I couldn't make any definite statement as to just when it was or how long ago it has been. I cannot tell you the year. I was in freight service.

On the air cylinders with the air reverse there are drain cocks; a small drain on them. In the freezing weather the engineer drains them himself on the road, and the shop force drains them. It doesn't take but very little moisture in zero weather to put your power reverse out of commission on account of freezing. I wouldn't say how much water. Very little dampness. I have never measured it. As to what pressure I have in those air cylinders: Whatever you have in your main reservoir. Between Connellsville and Sand Patch 110 pounds, and between Sand Patch and Cumberland 130 pounds standard pressure. With those pressures it only takes a little moisture to prevent them from operating. In zero weather it happens quite often. I have had it happen as much as
436 twice on *on* a trip between Cumberland and Connellsville or between Connellsville and Cumberland. I have had my air brakes freeze up. That has not happened very frequently. They would not freeze on the same occasions as my air reverse. You get the air from the same place. When the air froze on the brakes I stopped the train and thawed them out. As to how I stopped the train with frozen air brakes: Whenever your pressures begin to weaken every reduction you make on your brake pipe, experience teaches you you are losing your pressure although your gauge may show you how far as your gauge is concerned that you obtain standard pressure, but years of experience will teach you you haven't got your pressure, and in freezing weather when you have a condition like that I stop my train and investigate before the train entirely freezes up. I take no chances on it. I got it stopped before it was entirely frozen up. I did not stand still until it froze. With the assistance of the fireman and train crew we thawed them out about back five cars behind the engine. They were froze back that far between the hose connection, and we coupled up our train and proceeded to Cumberland.

REDIRECT EXAMINATION

•I have not had experience with the independent air freezing on the engine; not the independent air; the train brakes. It was with the train brakes I could tell when my pressure was getting low even though the gauge indicated standard pressure. On these occasions when my air reverse gear froze up I did not have any advance warning of that. I first found it out when I went to reverse the engine. Those air cocks counsel was asking about are located on

each end of the power reverse cylinder, underneath. You cannot turn them from the cab of the locomotive. In order to get at them you have to get down there, and if the elevation is not so
located you have to get up on the rods and get hold of them
437 to turn them and drain your cylinders.

"Examiner ROGERS. While Mr. Brotherton was on the stand yesterday a request was made for the work reports on engine no. 641 in 1928 and 1929 to be brought in. We deny the request at this time in this particular case."

L. G. ROUTE, engineer, B. & O. R.R., living at Baltimore, Md., and 53 years of age, testified:

I had some shop service with the Western Maryland prior to working for the B. & O. I had engine service with the B. & O., but this last time I was there with them the records were destroyed in the Baltimore fire and I give them my last hiring as 1902, October 22nd. That is when my turn starts with the B. & O. now. I have been with them twice. I started in 1902 as a fireman. I was promoted to be an engineer in 1907. And I went in service in 1908, in January. I have been operating engines for the B. & O. ever since that time principally in what they call the west end of the Baltimore division, but I have been in service on other divisions through delivering new engines. I have been in most all classes of service—yard, passenger, and freight. I have operated locomotives equipped with hand reverse gear and also locomotives equipped with the power reverse gear. As to how much of the time I have operated with power reverse gear: To divide it up I will say 75-percent manual bar operation and mixed 25 percent (T. 1632–1643).

In the late years I have operated the hand reverse gear by screw type, with the Q–4–B type. I have operated a lever equipped with the lever type of hand gear within the last few months. Now and then we get one of the Q–1–A or Q–1–AA, or whatever they are with the different equipment they have on them. Along with these two types of hand gears I have been getting the power gear from time to
time. We have a couple of new Mallets that came here, a
438 couple of new large passenger engines, and I made a few trips
on them breaking them in and trying them out. We had some reconditioned passenger engines that had been made heavier that had power reverse on, and we would break them before they would go into passenger service. That has been in recent years, or months. We got these Mallets around April. I would not say positively now. It has been this year. As nearly as I can recall it, it must have been around 1919 when I operated my first engines with power reverse gear. Prior to that time I had altogether the hand-lever type of engines. I would say the range of weights on drivers would run from 210,000, 212,000, and 220,000, up until the present day about 240,000 or 247,000 pounds, or something like that. The 240,000 pounds is the screw reverse operated. The others are the

hand lever manually operated engine. As to what has been my experience with the operation of the hand-lever type of reverse gear, that is, manually operated reverse gear, as to the amount of physical force or physical effort that I put forth, and my ability to handle these levers and operate the locomotives equipped with them: I couldn't say there was any cause there that would do me any injury in operating them. There are times when maybe we would have to use a little more strength than at other times, due perhaps to some condition which might arise that you would not notice until you made a stop, or something might get dry. I mostly use both hands to throw these levers. In using both hands I have been able to handle the locomotives and operate these levers. The screw type of gear is mostly a one-hand job. Neither one of these types caused any unusual or undue physical strain on me. I have never received any physical injury due to handling the manually operated reverse gears that I have operated. I consider the engines equipped with the manually operated reverse gears, as to my ability to maintain a fixed point of cut-off in operating the locomotives over the road,
438 better than the power reverse. The manually operated bar will stay where you put it. There is no creeping to it. I have had the manually operated bar type of lever type of reverse gear unlatched and go to the forward corner of the quadrant. I couldn't just recall the dates or the time. I just remember it only once. As to what was the cause of it that time: I found, it had clotted in there from the use of the sprinkling hose. Our quadrants are a little above the lever of the footboard, and washing us at the side of the cab the dirt and dust was in there, and it accumulated in there, and from time to time in operating the dog up and down it pressed this dirt down until it shortened the length of the teeth in both the latch and quadrant and it didn't have the proper hold, and the vibration of the engine and with the motion I suppose it kicked it loose. It went down into the corner. The engine was the one that got the shock from it. Afterwards I pulled it back and put it into place myself. My experience with the engines equipped with power reverse gears as to whether or not I was able to run them over the road and maintain a fixed point of cut-off: The late ones that I have run have been engines that were new or reconditioned engines and I can't say that I particularly had any trouble with those. As to how long a period of time that covers: Maybe it was the first trip they had been out of the shop or maybe the trip that they came from the locomotive works. That has been in the last few months. Prior to that time I ran one engine, the 4598, and it was around during the World War, during the Government administration, and I was working out of the southern terminal here, and I had that engine regular. I had considerable trouble with the engine creeping on the line of road. It had the Alco power reverse gear. I ran it in the neighborhood of a year. During that time the most I would notice the valve gear creeping or

that it would be noticeable to the engineer was when you were
440 working the engine at a long cut-off. It would sort of blank itself creeping back, and then it would go ahead with a loud or short exhaust, for some cause, the air leaking away from the piston, or at times I have found the piston rod packing of the power reverse was leaking and it would not maintain the air ahead of the cylinder. I got that engine new or practically new. After I had her a while I had considerable trouble with her doing that. It was a few months after I had her I began to experience that trouble. The first creeping I noticed was at the terminal. There would be times that we were rushed so for power that I would be called and they hadn't quite completed the oiling of the stoker and the air pumps, and while I was doing my line of work around the engine to get her ready for the trip maybe the air men would shut the pumps off and drain the reservoir so as to oil the oil cups, and when he would start the pumps again and recharge the system I would notice, if I happened to be around the link, that the blocks would lift again. They would lift to the extent that when the air leaked from the cylinder the amount of the weight of the hand gear dropped and it let the links drop; they would drop forward, because the rules were for all engines to be as near center as possible when left on the ready track or roundhouse stalls. As to what I have reference to when I say the weight of the hand gear: You see the power reverse has a sort of equalization on it on each side of the pistons to maintain the valves in the position that you have your bar set. When those valve gears would move and the air was being pumped up in that way, they would lift, and sometimes before the pressure was equalized they would drop a little. They might move up and down a couple of inches, or something like that. In my experience they moved slow. The pressure would be built up slow and they always start to pump at a low rate of speed. The valve gear just climbs up as the pressure builds up. I have heard them exhaust standing at the station and they would move. I have heard the air at the exhaust
441 when the engine was standing with the bar in the center—the exhaust with the power reverse, without anyone touching them. On those occasions the valve gear would move. Maybe it would lift or maybe it would drop. I have had other experience with creeping while on the road with these power reverse gears on the engines other than the 4598. We have the Q–4 or the Q–4–A, I believe it is. We have five engines equipped with the power reverse of the 2–8–2 engines. They are the same type excepting the power reverse, and the company uses them in helper service, and they never use them in road service, in through service, except in emergency. And I happened to have one of them lately, in the last couple of months, although I cannot recall the time, and it did a considerable lot of creeping. The trip I had with it was 78 miles.

"Q. In your experience with these engines creeping on the road have you ever had the experience of one of them creeping back to such an extent as to cut itself out?

"A. Well, I have had them to adjust, about blanking themselves; in case I would want to make the shorter cut-off, when I would start the bar back I would feel a bump and it would sort of go lame and the exhaust cut down, and I would have to drop her a little ahead to overcome that. I have never had them pass the center with me."

As to what I mean by feeling a bump: You can feel that little shock on that little bar. You have to loosen that bar to move the valve to admit the air. The air operates that. If it chooses to go down I cannot prohibit it from going down. As to whether when I had these engines that were creeping that had any effect upon my operation or my action in operating the locomotive: In regard to speed, it does.

" Q. Does it have any effect upon the operation of the locomotive?

"A. Coal and water.

442 " Q. What effect, if any did it have upon you as to the amount of time required to maintain the cut-off (T. 1643–1653)?

"A. Well, it requires right smart attention to the reverse equipment."

As between the two types of gear, the hand operated type and the power type, I have experienced in general no difference between my ability to keep a look-out on the two types. From the standpoint of the efficiency of operation of the engine I have found the hand lever type to be the more efficient because they do not appear to have the lost motion. There is no creeping to the hand lever that there is with the power reverse. As to how that affects the efficiency: It requires you to use more coal, and if an engine continually changes her cut-off it is going to be a light admission of steam or a heavy admission, and that will interfere with the man trying to keep a perfect water level. If it were not for that it would not be necessary to cut an engine back at all; you could just keep on hooking up and going on. As to the comparative safety of the two types of gear, I would not say any except the point of the ready track and shop or letting the engine alone or working around it with air being added to the steam from an empty steam to recharging it, or like workmen around the shop. Under those conditions I think the manual lever or the manual screw would be the safest.

CROSS-EXAMINATION

I said on some occasions something might get dry when I was operating the hand-reverse engine and I would not know it until I went to handle the lever. Under those circumstances if you attempted to hook up the engine or drop it down dry valves would catch you unawares, and if there was any jerking of the lever you would not be prepared for it. As to how I prepare myself:

443 That is why I always use two hands to operate a bar, because the bar, when it stops up there—you can take that as the reverse lever [indicating]. Here is a latch and here is your

lever [indicating]. If I take one hand there and grab it I have more of a grip to hold it with one hand and if I loosen it with one hand against the latch and this went up, and my feet here, I have a chance to let it do whatever I please. And I would try to hold it. And if I let go of the latch the chances are that it is going to stop before it hits the corner, because when I operate it—and I have done it for years, one engine with the manual bar. And you take two hands because you rasp, you unlatch, and you rasp it back and forth by one hand, and a lot of men are responsible for that condition in that dog and that latch. I do it for my own convenience and position to keep the strain from my body. Any man who reaches around to catch the bar creates a strain on himself that is unjust to him that he does not have to do. As to whether my practice is always to brace myself when I go to hook up an engine, I sit on the seat and very seldom get up except to change my position where I was for a long time from handling a heavy switching job at the camps during the war and on the road, and I worked at those times up to 16 hours, and, of course, at those times you would like to change your position. Some engines are equipped with the foot brace—the majority of them—and I use that in handling the lever. There is no real need on power-reversed engines for bracing yourself, but you always have to get up to get it and bring it back. There is a motion. There is the same as there is with the hand-operated engine or with the hand-lever-operated engine. You could not at all times do that with one hand. There are conditions at times with the power reverse where if you reach down to pull her, if there was a creeping condition when you got her near the center, you would get a little shock from the air leaking somewhere from some cause that we can't see from the cylinder. It is on the inside of the cylinder or the packing, but we don't know which it is that would cause it, and it might kick over the center if you were
444 not on guard. I have never had it kick over the center.

"Q. And with the manual reverse you say you feel a strain in your body and that is why you take both hands and brace yourself?

"A. I would be creating a strain which would not be necessary. I have reversed many of them with one hand."

With the other hand I just reach down and get it because I can pull it up here even without looking down [indicating]. When riding on the engine you can tell about the point you want to cut it back to, or if you want to reverse it you can pull it back. I can't say there is any strain I can make any complaint about with the power reverse, because the company has told us that we must have a one-man bar that can be operated from the seat before we leave. Our relief department demands that from the company for our protection.

"Q. In other words, if the manually operated lever should work so hard that it would take more strength than a one man bar you would think that would be dangerous, wouldn't you, Mr. Route?

"A. I would not leave the ready track. If it occurred at the terminal I would not leave the ready track with it."

That would be because they told me I must have a one-man bar, and they back me on it. I think a bar that would require more strength than what you consider a one-man bar requires would likely injure you. If I was injured I wouldn't get any compensation because I wilfully did it myself. If I took out a lever that worked so hard that I would object to it there may be a possibility of my injuring myself. But if I left the ready track with it I would be man enough to keep my mouth shut when I got started and do the best I could. It is possible for a lever to be as stiff as I say the company does not want a man to take it out. Such a condition could develop on the road after you had started. Under those circumstances
445 if it came to a danger point I would ask for assistance or ask for another engine to tow me in. Over the road it could come to a danger point even though it was all right when you started out, if a man chooses to pull to that extent on the bar. I don't know that this danger point might arise while you were in the act of hooking her up or letting her down on the road. I don't know that rings breaking in a valve would cause it. If I had a ring break and it would stick in the port, that would not give a sufficient jerk on the lever to throw me off my balance. That would have a tendency to stop the whole works or tear the engine up, if the ring was strong enough to overcome some of the weaker points than the ring, and it would help to tear the valve gear some place or break something else, or break the valve stem. If it tore the valve gear there might be a little shock, because the port opening is limited. That would not throw a bar from one end to the other because a ring got into the port. If the bar stuck suddenly when I was pulling on it, I would feel it. I cannot say that it would throw me down or strain something internally. I have had experience with the hand-operated lever vibrating in the quadrant and chattering as I go along over the road.

"Q. That has a tendency to have it work out of the quadrant, doesen't it?

"A. Yes, sir; not if you have your proper thumb latch spring it has no tendency to do it.

"Q. On the occasion you had dirt in the quadrant and the lever jumped out and went into the corner the latch spring did not stop it that time, did it?

"A. But it was raised. The tension was taken away because the latch was lifted and the dirt allowing it to go back."

446 It would be impossible for me to say whether there was dirt in all of the notches all of the way down the quadrant at that time or not. I never stopped to take it out. We stopped at the pen stock to take water. We didn't make that stop for that occasion but we made it for water (T. 1653–1661). Most of the dirt that I dug out was in the top latch, where it slides down in the quadrant. If the latch was worn or the notches in the quadrant were worn to any extent it would not hold. I would not

consider it a danger condition from my point of view, because they give me plenty of clearance in the cab to keep away from the bar if any such conditions should happen. I never put my foot on the quadrant when I am running along to relax myself. I don't have any occasion to put any part of my body there unless I would so minded as to wilfully do it. As to whether I sometimes take that position to relax myself: I lay my hand on the latch of the rack. I mean on the lever. I never have to move across my quadrant or in front of it to look at the lubricator any other *other* devices, not while I am running. I have gone back of the reverse lever and looked at the lubricator at times, but very seldom. If it were just personal for my own convenience I would say I prefer the power reverse lever to the manual, but for the most comfortable operation of a locomotive with regard to sometimes a man gets criticism about it, calling him a heavy hitter, or what you are doing with them, I would take the old reverse lever.

"Q. If the power reverse levers are maintained so that they will keep a fixed point of cut-off you would not have any criticism of them?

"A. My little experience with them—not just of late, because I haven't had any, with the exception of to the extent of a trip or two with new engines or reconditioned engines, not enough to know what they would do, but they are not maintained in a proper condition as long as a manual reverse bar will be."

447 If they are maintained in the condition in which these new engines are, then I would have no criticism on the operation of the power reverse engine. As to what I refer to when I say "not on the engine": In regard to some conditions that come up about the air system being drained and then recharged, about the creeping of that on the ready tracks. I never have observed the engine move when the air cylinders are being drained, because the cylinder cocks have been opened, and I suppose that happened to be that I had a leaky engine. Sometimes the throttle will leak. But I had no leaky throttle on the engine I was operating at that time. I have never been hurt myself or seen anyone hurt. As to whether that is the only thing I have in mind on which I criticize the power reverse: In the creeping and what I said about the shop conditions and maintenance of fuel and water. If the creeping is overcome then I have no criticism except this about the links moving when the air cylinders are drained. But I haven't had any experience yet. I mean what I did have when on engines in service and what has had the creeping disposition about it. The only engines I have had in recent years with the exception of one or two trips are those which were new from the factory or shop that are equipped with power reverse. It takes only a short time to correct the creeping by adjusting the lever. There is nothing about the creeping of the engine when you are out on the road that may injure you, not while we are in motion and working air, but if I would have any cause to work about the hand gear it would

be advisable for a man to drain his system. I have had experience in handling engines when they were equipped with manual reverse which were new out of the shop, and the bearings are often very neat. At first when those engines come out it requires considerable effort to operate the lever. But there is always a trial or a test engineer who tries them out before we get them in road service. They are generally a little stiffer than the others. As to
448 whether you have to brace yourself and use a good deal of strength: It is natural that they would. I have had these engines equipped with power reverse new out of the shop and from the factory and have never had any trouble in reversing an engine with those power gears, outside of their being slow when they are new, which shows they have a tendency to have a drag, too, the same as the manual power. The air would operate it. After I put it in the end of the cylinder it would operate it. There is much less strain on us in handling an engine out of the shop with power reverse than there is with manual reverse, because all we do is move the bar. But there is no physical danger in operating one of them because we have had men who took those jobs who were physically unfit for road service and have taken those jobs to work them because they were all daylight work and where they were close to home. I don't know what experience they have had. I just made that statement, or I just said that because there are always some of the shop forces with the engine when it goes out for the adjustment. They have three men on the engine usually to break it in, a brakeman, a fireman and the engineer, and then the shopman. Sometimes the foreman goes with them for the adjustment. I can keep the same look-out with the hand reverse as I can with the power reverse. If I am sitting looking forward in my locomotive; if I wanted to get a signal from the back I would look around back at them.

"Q. Suppose your reverse lever were in full forward motion; about where would it be?

"A. It would be down here [indicating]. It would just about reach, according to the seat you have. Some engines have a little larger seat and maybe some large man had it regular and he had asked for a seat and they made a change in it for him."

449 I don't pretend to reverse an engine while I am looking back for a signal, because I don't reverse it until it stops. In getting a signal from the back I couldn't reach the lever with both hands if it were in full forward position. After I get my signal it would be necessary for me to change my position and come inside to reach my lever. As to whether I would have to do that or follow the same procedure if I had the power reverse: Yes, on some engines and lots of them you cannot reach up there and look back and reach up there for the lever of the power reverse. On our engines you can't reach the power reverse and be looking backwards out of the window—not unless you choose to turn yourself. I said

you would have to look back to reach it, with the power reverse. Your act is with your head back and you reach for a bar and operate the engine because you are not supposed to reverse an engine until she comes to rest. I wouldn't say that the power-reverse lever on all our engines are so located that you could not take a signal from the back and have hold of and operate your power reverse lever. But when we come to looking back for the signal and are reversing, at the time you do it, you can't do it. That was the 4598, around the last of 1918 or 1919. I don't just recall exactly. That is about 12 or 13 years ago. I had the Alco power reverse on that engine; that was an old type of reverse. I believe they have taken this kind off and put screws on the most of them. That is the last experience I have had with power reverse, back in 1919, except a little mixed with these new engines and once in a while getting hold of a helper engine coming through just for an occasional trip. My testimony has been with respect to engine no. 4598 that I had during the war. My testimony with respect to the effect on the steam and coal and water was also with respect to that engine, and occasionally on these other Q–4–A type. They keep them in helper service due to the fact that they can't make the runs in fast freight as to water
450 and coal like they do on the other same class of engines, with the same amount of coal in the tank and the same amount of water. They don't run them through from Brunswick to Willsmere in fast freight due to the fact they don't hold up on coal and water like the others do. The tank has the same capacity for coal and water.

"Q. But you say that the effect of the power reverse gear on the coal and water consumption is so high that they do not use the engines that have a power reverse on the through trip?

"A. Those four engines that are here. I believe there is one in the West now some place. But we have four on the division and they use them in helper service."

When I was operating those particular engines with the power reverse I observed the excessive use of coal and water. As to whether I have any idea what percentage more of coal and water they would us than where you had manual reverse: With the little experience I have had with them, I could take a Q–4 engine, and we have a train called "No. 93" which is a merchandise train for the West, and unless something occurs to delay us we run 57 miles for water with it. On this occasion I had this engine I had taken water at about 33 or 34 miles from the terminal, whereas I might have had enough water in the tank to go to what you call the top of the hill, to Mt. Airy junction, and where we mostly go through to Frederick Junction, 57 miles, where we have some merchandise to be set off for the Frederick transfer; and they only want us to make the one stop, if it is possible, in order to keep down the delay on the train. I would not say that the same type of engine with the manual reverse uses 25 percent more coal and water than an engine with the power re-

verse, because I don't have experience enough with them, with the type of engines that we use with the manually operated bar. I couldn't say that because I don't get enough of that power reverse to say what percentage it would use. I have operated the same
451 type engine with both power reverse and manual reverse. On this trip I was just telling about the power reverse used more coal and water. I couldn't say in that case that it used exactly 25 percent more, because I didn't run it its limit. I didn't take chances on running the limit with the tank, because I had 11 miles of heavy grade in front of me where I took water. I couldn't say it would use 20 percent more because I don't know. I am only answering as to this one case where I know positively what occurred with me. That is all I can say.

"Q. Then you don't want to say that the usual thing is that locomotives with power reverse use more coal and water than engines with manual reverse?

"A. If I was running a mixed service all of the time and with all of the types I would be willing to answer that question, but I am not in position to answer it."

I mean on this trip I was telling you about the engines with the power reverse would use more coal and water than a similar engine with a manual reverse (T. 1661–1674). If you want to ask me about the 4598, I will tell you yes, and I will say she used 25 percent more coal when she got to creeping than when she did not creep, and I can prove it. When I ran that engine I made as high as 168 miles with a tank of coal and sometimes I picked up a double train on the line of road. And when she would get creeping I would have to get coal before I could complete my trip. That is 12 years ago. I am saying now from that experience that engines with power reverse use 25 percent more coal and water than an engine of the same type and class with the manual reverse. That is the only experience from which I make that statement. The type of power reverse I had on that engine is not appearing on any of the new locomotives that I have had during the last five or six years; I will not say they are.

452 I couldn't positively say if on that occasion the gear was creeping more than they ordinarily do. From the experience I have had with them I was telling how they would creep. At the time they would creep on the special occasions I noticed this, I was operating this engine between Potomac Yard and Baltimore. I would take my train at Potomac Yard going to Baltimore, take one back to Potomac Yard and pick up one and go the same way, and then make the four ways, which amounted to about 168 miles. When we had creeping at times we had the same tonnage. That was the power reverse gear that I was operating at that time. As to how many times I had the power reverse gear engines creep as that engine did when I was running the 4598: This Q–4–A type, I had one of those just a short time ago, a month or six weeks ago, or

maybe two months, and it crept considerably. It was creeping worse on that occasion. My experience with it has been very little lately. That is why I said it was 25% then; but it wouldn't be that great, but I gave it as the best of my judgment (T.1675–1676).

REDIRECT EXAMINATION

The 4598 had the Alco reverse gear on it, the first Alco that came out. I have seen cuts of the later Alcos. I don't know if I have operated an egine with one or not. As to the difference between the type that was on the 4598 and the later type: I had one engine that had a litttle wheel that you screw, but I never looked to see what kind of cylinder or what make it was. I haven't been out to look at it as the engine was going off the division. When the counsel asked me about strain and the comparison of strains in handling reverse levers, what I understood him to mean was did it tire me out or give me any physical strain that would be unjust to me after the day's
453 work. I never had anything that created any discomfort or kept me from any pleasure, and I worked the limit of hours with them, by which I mean under the service law, 15 hours and 55 minutes. And I have worked longer. When they found out the meaning of the word " respite " I have had the use that on me during the war and I worked considerably longer. I mean with a hand lever equipped engine. As to how long the breaking-in trip is when they usually take these locomotives with an engineer, fireman, and flagman that I spoke of: I don't know just what is required. I worked the job and they didn't tell me. They told me to take her out and exercise her. I have taken them out and run them 20 to 30 miles to a turning point, and maybe two or three of those trips before bringing her in. I was on that service, as a " lion-tamer ", when one of the trial engineers was on vacation or sick—for a few months. They have the same number of men on the locomotive when taking it out on the trial trip, equipped with power reverse gear, as they have when it is equipped with hand reverse. I can recall one instance in handling a train on the road where I had to handle the reverse lever when the throttle was wide open. I had an engine and 95 empty coal cars going west. When I got to the top of the hill I went to ease-in my throttle and I found I couldn't shove the lever in, and I was starting over the top of the hill. When I got to where my train would move with very little power of the engine I cut my lever back as near a cut-off as she would stand without pumping herself and I went on down the hill the same as usual. I had a manual reversing lever. The top of the hill is about 41 miles from, and I was about 27 miles from, the terminal. This type was a lever type. I was not able to push my throttle in before I got to the end of the trip.
454 I operated the hand reverse lever myself on that trip; I operated the speed with the bar and with the air on the hill, and the bar on the other part of the road where it would require steam to pull

it. I think one of the packing rings in the throttle had broken or worked out and got down under the valve and wouldn't let it seat. They have a little ring in the throttle. There was a piece of iron for some cause got under there; just what I don't know. I had difficulty in handling the lever handle on that trip because I had no occasion to full stroke the engine and I only used it at a cut-off where I could handle my train, because it wasn't necessary to have to corner the engine. I made one stop before getting in; I stopped it with the air with the bar in the center and I stopped with the train brakes. I didn't cut loose from the train after getting in the terminal; I pulled into the clear in the terminal and dumped the fire and blew the steam off and let the yard crew handle the engine and train. I have had another experience of that kind with a manually operated reverse gear; I had a coal train coming east. I had a screw reverse throttle to stick open on the hill. That was the screw-reverse gear, the Q–4–B locomotive, 247,000 pounds. I was about 40 miles from the terminal. They stopped me at Mt. Airy junction, which is the returning point of helpers. And I stalled myself with the train brakes, and by cutting the engine back to a short cut-off went to the tower and told the operator to tell the train runner to let a helper come and get me to assist me through the tunnel, on account of starting there. It is a right heavy pull, and I was afraid a gasket might slip on it in there and I would have to full-stroke her. So I used her as a short cut-off through there until I got through. As to what is the difference in working at full stroke under those conditions and working hooked-up pretty well:

455 You use your steam more extensively and by cutting it back with a short cut-off your travel of the valve is shortened and it doesn't admit as big a volume of steam. Your port is not opened as long or as wide. It makes it easier in handling the lever, a little easier. If, on either one of these occasions, I had an engine equipped with power-reverse gear, I may have handled the train in the way described, but I do not believe I could have handled it as easily or without severe shock, because I couldn't have graduated my reverse in back or forward motion as I wanted it as I did with the manual bar, because with the manual bar, I can take a notch at a time whereas, if anything did take place, if the power reverse had been creeping, it might have kicked it over with me as I passed the center. I said it might have kicked over because if they are creeping there certainly would be some tendency to pass the center. As to whether I have ever had one pass the center: I would have to pass the center if I was reversing the engine. I would have been standing up there some place now with the road tied up and someone coming to drag me in. I have never had a power reverse creep back and pass the center. We were not talking about reversing the engine on this occasion.

As to why they call these men "lion tamers", I don't know; that originated in the West; I didn't hear that until I got in this room.

In my territory we call them trial engineers or test engineers, not lion tamers. I have no idea why they call them that.

There is no reason why you should not reverse this engine I was bringing in with the throttle open if I had a power reverse, but if you had a creeping bar, as you call it, when we passed a point or the center you have to reduce the air on one end or the other
456 on that power reverse to cause that to travel, because if the pressure stays equal on the piston you couldn't get it over the center; and you must reduce and increase from one end to the other to get it to travel. So with the weaker side it would have a tendency to come back with a jerk.

I will say I never had the lever creep past the center. I likewise said I can reverse the engine with power reverse. I never had an engine that I could not reverse with power reverse (T. 1676–1686).

B. F. FREELAND, for defendants, testified:

I am a locomotive engineer on the B. & O. and live in Cumberland. I was hired in 1898 as a fireman and promoted in 1900. I serve on the west end of the Cumberland division between Cumberland and Grafton and Fairmont. I have had no experience on any other railroad and all of my experience on the B. & O. has been in the same territory. I have been employed continuously since 1900 as a locomotive engineer in all classes of service, passenger, freight, and yard. Up to 1914 my service was exclusively on manual reverse engines. That is the time I first had experience with power reverse. Since then my time has been mostly on power reverse. I continued to have some experience with hand reverse engines since 1914, up to now, and still get some of them.

All of my experience, from my promotion until 1914, was in handling hand reversed engines. I have never been injured or experienced any particular difficulty in handling them. My hand reverse experience has been on engines from 153,000 pounds to 222,000 pounds. I have never been exhausted at the end of a day's work or at any time during the day's work in operating a hand reversed engine. I never had any difficulty in seeing ahead when operating a hand reversed engine; it takes just the same time for a lookout whether handling hand reversed or air reversed engines. That
457 is true in yard service as well as in road service. I never had any difficulty in getting signals in the yard service when I had a hand reversed engine, or any difficulty about a signal being changed after I got it and I was not getting the change.

I have had experience with Ragonnet, type A, Alco, type G, and the Barco, air reverses. My experience at the present time covers those 3 types. I have had some right smart experience with creeping of the power reverse gear. With the type Q–3, that is, the 4500s engine, they crept pretty badly most of the time. On January 7, 1929, I ran an engine, in the daytime; it was no. 94, a fast freight, engine number TA, 5501, with a 4–8–2 wheel arrangement. The weight on drivers was 275,000 pounds. It had an Alco, type G,

reverse gear, which is one of the later types. I was running at 45 miles an hour when something happened; I was on a slight descending grade and I heard something like the cylinder cocks open. I looked out the side of the boiler. It was air reverse, and the piston going from one end of the cylinder to the other, backwards and forwards. I mean the air piston and air cylinder. I could look out and observe it. It was moving backwards and forwards very fast—completely from the forward position to the rear position. I call that pumping. That broke the engine down on the left. The engine every time it reversed itself, it would go in the train, and it kept going back and forth that way all the time. It was back and forth against the train; that is, the engine pumping back and forth against the train. That affected the movement of the train; it caused a jar, the slack would run in and out. To overcome that I put the bar down, shut the throttle off, and applied the brake—made a service application. I threw the reverse lever forward to stop
458 the pumping, that is, to try to run on in full stroke. Then the bolts in the lifting shaft arm on the left side broke. The lifting shaft arm is part of the valve gear. I could tell something was broke on the left hand side because the effect was to full stroke that side before I got my bar down. Before I got my bar down my left side was in full stroke and my right side was not. That occurred after I observed this bumping of the power reverse. The train came to a stop. I got out then to examine to see what was broken and found these bolts broken. You can tell if the bolts broke after the power reverse started pumping or before, by the exhaust. They broke after; after I observed the pumping of the power reverse. I ran about a quarter of a mile with the power reverse pumping before these bolts broke or before the break occurred. I was not injured as a result of that. An occurrence like that would be dangerous to the train crew or anybody who might be around on the track. That was a freight train. I don't know what caused the reverse gear to act that way; I reported it at the shop. I ran the engine on in in full stroke. I had no trouble with it. I ran it about 15 miles an hour. I had a slight delay due to that, lost about 15 minutes. That was on January 7, 1929.

On January 15, 1929, I had the same engine. In the meantime this broken part had been repaired. I did not observe everything that was done to the engine in the shop, but I did observe that this particular breakage had been repaired. I had a passenger train, no. 21, a fast train, called the New York-Chicago express. It still had this same type G Alco power reverse gear on it. Something happened while running it on that occasion. I was about 50 miles from my home terminal. Neither prior to the occurrence de-
459 scribed on the January 7th run nor on this run, did I have any lubrication trouble. On this occasion the power reverse pumped the same as it did before. By pumping I mean going from one end of the cylinder to the other. I was traveling about 45 miles

an hour, going down hill. The effect was to jar the engine back against the train and jerk ahead. The throttle was off when that happened. To overcome it, I put the brake on; I commenced to make a service application but the brake went in emergency of its own accord. The throttle was closed. I said the brake went in emergency of its own accord. What caused it to go on was the engine broke down and the broken part knocked her pipes off. It broke the air pump. The brake pipe broke. The emergency application of the brakes stopped the train. I examined to see what happened and found the connection lever or arm to the eccentric rod broken. That is on the left side of the engine. I found the air pump and the air pipe had been broken. With that condition I could not go on. I got another engine. I examined the break in that eccentric rod connection arm. It was a fresh break; part of the arm was broken off. It was missing when I examined it. They call that the jaw end of the eccentric rod connection arm. I did not find it. There was snow on the ground. The air reverse caused the connecting rod to break. As to how I arrived at that conclusion: The first time I saw it was daylight and the next time the fireman told me after I had seen it that the engine was broken down on the left side. This occurred while this piston was going from one end of the cylinder to the other.

"Q. What I don't know is whether the breaking of the eccentric rod cause the piston to go from one end to the other due to a break in something else or whether the action of the reverse gear piston caused all of the other things to happen. Now do you know?

"A. Yes, sir."

The pumping of the power reverse happened first. I
460 answered when the engine went into emergency with reference to this action of the piston.

With a breakdown of the kind described, there would be a danger of hurting the passengers, the crew, or derailing the engine. Various things could happen with a breakdown of that kind (T. 1686–1704).

June 12, 1931

B. F. Freeland (continuing) testified:

As to whether I have in mind, in addition to the two cases recited yesterday, of power reverse gears creeping to the point of reversing while the engine is running: I have in mind such a case, occurring some time in 1921. I do not know the exact date. I was running no. 3, the Cincinnati express, a passenger train. It was a Q–3 engine, with a 2–8–2 wheel arrangement. It is a Mikado, weight 222,000 pounds on drivers, with a Ragonnet power reverse, type B. The run was Cumberland, Md., to Grafton, W.Va. After leaving Cumberland and before getting to Newburg, I experienced difficulty with that power reverse creeping. As I was leaving Newburg, I went to cut the engine back in short cut-off, and the creeping of the

bar put it back in the back motion. That had the effect of slowing up the engine and the train ran into the engine causing a jerk—bumped it. To overcome that, I put the bar ahead again. As I said, the effect was to pull out the slack and jerk the train. Someone on the train then reported me for rough handling, and the road foreman of engines called me up about it. I explained to him what happened. I have never been reported for rough handling of a passenger train, when equipped with a hand reverse.

Yesterday I testified about the occurrence on January 15, 1929, when engine 5501 was equipped with an Alco type G power
461 reverse. After that the Alco was removed and the Barco put on instead. Thereafter I had that engine with the Barco on it. On November 14, 1929, I had that engine on a regular passenger run between Keyser and Grafton; she had been off the run 2 days, and I was expecting to get her on the run, and she was marked up on the board. A little later that evening I went down and they had a Q–4 engine marked up instead. I wanted to find out why the 5501 was not going on the run. As a result of what was told me, I went and looked at the engine, and found the Barco power reverse lying on the floor, on the side of the engine, dismantled. The engine was down in the roundhouse and did not go on that run. In the last 2 weeks, I have had difficulty with the Barco power reverse on a Mallet engine, no. 7162, wheel arrangement 2–8–8–0, weight on drivers 466,300 pounds. It had a Barco power reverse; I don't remember the type. This occurred in Grafton Yard. Prior to the difficulty, I had run the engine from the ready track, about a half mile to the yard, the movement being forward. I was going to take a train. After running that half mile forward, I reversed and made my backward movement in the yard to let a yard engine pass me and to clear the track. I then stopped, and then made an effort to put it on forward motion to move forward again, but it would not go; I could not put it into forward motion. I did everything an engineer could possibly do with the hand lever, but it would not go in forward motion. After it would not go, the fireman took the grate shaker, getting off the engine with it, and put it in the valve motion and helped to reverse the engine in the forward motion. I stayed on the seat and helped with the power reverse lever; he used the grate bar shaker in the valve gear outside. I finally got it over after about 20 minutes. There is danger in that operation of the fireman using the grate bar shaker to try to move the
462 valve gear with the power reverse applied. Based on my experience of about 31 years as a locomotive engineer and my experience with both types of reverse gear, the hand reverse gear is the safest (T. 1706–1713).

CROSS-EXAMINATION

I am 59, and have been running since 1900. I am a member of the engineers brotherhood; my position is no. 437. In handling a manual

reverse, in about 3 or 4 instances the bar went down in the corner; jumped out of the quadrant and went down. I have had engines where it took some considerable amount of effort to throw over the bar. When handling that kind of engine, I would brace myself; it was a precaution I took against anything happening if the machinery would break at any time at all, and I would keep from getting thrown. I have never been thrown with either the power reverse or the hand reverse. The power reverse lever is about 12 inches high.

"Q. There is not any danger of that throwing you to the extent that a manual reverse lever would, if it got loose?

"A. No; it would not throw you."

I have had many engines equipped with power reverse where the lever has maintained the proper cut-off. Some, if the power reverse mechanism is maintained in proper shape, when they are new, do not creep; but they do not run very long until they do. I do not know what makes them creep. In that instance with engine no. 5501, I was not hurt on that occasion and no one was hurt on the train. I all the instances I described of difficulty with power reverse, I never had an injury. In the first instance where the bolts broke loose, I know what caused that; the power reverse, pumping
463 from one end of the cylinder to the other, the strain was so great it caused the bolts to break. At the time the valves were in good shape, well lubricated. My attention was attracted then by a whistling noise; that was the first I knew that the lever was pumping. I then looked out and saw the lever pumping. Those bolts could not have broken first and caused that disturbance in the air cylinder, because if that happened we would have a lame engine. As to the effect that pumping would have on the working of the engine: The engine went against the train and away from the train, shoved the slack up and pulled it out. That is all; it would not strain the machinery nor would it cause the bolts to break. The pumping must have been the cause of the breaking of the bolts. Those bolts connect the lifting shaft on to the tumbling shaft, and if they broke it would let the link down. If the link on one side were let down, because of the bolts breaking, the link on the other side would stay the same as it was. I do not know if the strain reflected by that would appear back in the air cylinder.

This was not a Mallet engine. When this accident happened, I was working my engine pretty well back in short cut-off. The links were up about center motion, just a little bit forward. When these bolts broke, it would not have any effect on the links except to put one side in extreme forward motion; the other side would be working on center. It would not hurt the locomotive any. If one engine was in back motion and one in forward motion, it would affect the train; it would not be working against herself, one in forward motion and the other cut back.

The first notice I had of any trouble was a whistling sound, like the cylinder cocks open. If the engine had been pumping, and

throwing the valve gear from forward motion to back motion, I would have known that without hearing a whistling sound. The whistling sound came to my notice first. If an engine would
464 be throwing herself from forward to backward motion, I would have notice that first, if it was very bad. If it did it at all, or came beyond the center, I do not know that I would notice that at all. If one link would drop to extreme forward position and the other link would say up in the center, that would not cause a whistling sensation in the cylinder cock. I do not know what caused the piston in the air chamber to go backward and forward. I could have happened with air in both ends of my air cylinder. That could occur by the piston pumping back and forth and forcing the rotary valve off its seat. It would have to be some pressure forcing against the piston to compress air enough to force a rotary valve off its seat. That pressure could come from the main reservoir, and if it did, the same pressure would be behind the piston as in front. I do not know where the strain against the piston came from. The different working of my valve gear, one link being in total forward motion and the other being on the center, I know would not do it. I do not know, though, what would do it. This is a piston valve. I do not know if the valve rings were all right in my engine; I made no examination. A broken valve ring catching in the port possibly could have that effect. That could not have done this damage after the bolts broke and let the link down. It could by pumping before the bolts broke. There are no valve strips on a piston valve engine. Speaking of the valve piston ring: It could have that effect in long stroke, but these bolts broke before she got a long stroke. The rotary valve in the air cylinder is all in the inside of the power reverse. If you lifted the rotary right up off the seat, the air would go in the exhaust port; it would relieve the pressure. The exhaust on one side of the piston would take the air all out. If your rotary valve lifted right off the seat, the air pressure would be all on one side; it would be off one side and on the other side. It would pump under those conditions.
465 I do not know what would force it. It would go back on the other side, but come back. If the rotary valve was lifted up off its seat and pried up, it would not go over (T. 1714–1724).

On the next occasion, the eccentric arm, connecting rod, broke, at the bow end. That kind of break is serious enough to derail the engine or do most anything. The position of the link would then be just the same as on the previous one; just the same as it was before the left side was down in forward motion and the right side cut up over. If I had a manual reverse bar in the cab, under circumstances like that, I do not think it would hurt anything. I do not think the force would be sufficient to take that out of the quadrant. I do not think the force of the break was the cause of the pumping. If the eccentric arm broke at the bow end, one side would be in full

stroke and the other side cut up, with the hand reverse. On a manual engine, there would not be any strain on the tumbling shaft with the full stroke side cut-off from the tumbling shaft. This occasion when the end of the eccentric rod broke was just like the other; my answer as to what caused it in the other case would apply here too.

On this occasion in the Grafton yard, with a Mallet engine, where the lever would not go in forward motion, that was the only time on that trip I had trouble operating the lever. I did not find out why it would not reverse the engine. On that occasion I continued my run with the same engine and had no trouble.

With the Barco power reverse, there is provision made for operating the mechanism without the necessity of putting the shaker bar into the link. I could not get to it to try that. We could have taken a monkey wrench and reverse it, but we could not get to it because the reach rod was right under the cap and there was not
466 enough room to take the cap off. So far as I know, it was properly installed. With the Alco, I do not know if there is any way in which the air pressure in the reverse mechanism could cause the piston to go back and forth; it did not do it, that is all I know. I saw that it did not do it. I do not know that the air pressure could not make the piston go back and forth. If there had been anything wrong with the mechanism, it would have showed it in the traveling of the engine. I do not know if the air pressure in the power reverse mechanism on an Alco would cause the piston in the air cylinder to go backwards and forwards.

REDIRECT EXAMINATION

Creeping might have caused this pumping. Creeping and pumping are the same thing except pumping goes clear back and creeping part way. If it went into the back motion, with creeping it only goes part way up to the center. It is my opinion that the same causes which might cause creeping might cause this pumping.

As to whether on these two occasions, January 7 and 15, I could definitely tell at what point of time the left side of my engine would lame in comparison with the right side, and whether that occurred before or after I had observed the pumping of the air cylinder: It occurred after I observed the pumping of the air cylinder. In recent years I have had no occasions where a hand bar kicked out of the quadrant and went into the forward motion; the last time was before 1914. There has been improvement in my territory on maintenance since that time. I say 1914 because I have not run so awful many hand reverse engines since then. I have run a few. I could not tell you how many. When I did see the hand lever kick, the type of valve gear concerned was the slide valves. I have never had that experience when I had piston valves (T. 1724–1733).

467 F. R. McFARLAND, on behalf of defendants, testified:

I live in Cumberland, Md., and am employed by the B. & O. as back shop foreman in the Cumberland back shop. That back shop is limited to the Cumberland division, and part of the Connellsville and Pittsburgh divisions. I am a machinist by trade.

I entered the railroad service on April 30, 1899, entering on the machinist's trade on November 1, 1899. I finished my trade Nov. 1, 1903. I worked as machinist until Feb. 1, 1918, when I was promoted to foreman in the back shop. The Cumberland back shop is equipped and used by all heavy type mountain, Santa Fe and Mallet heavy freight locomotives. Since 1912, I have had experience with installation, repair and maintenance of power reverse gears. It has been continuous service, except several furloughs in between. The first type of power reverse with which I had experience is the Meline or Moline; I do not know the spelling; it is the old type of power reverse on the B. & O. It was the first type coming to the B. & O.—about 1912. The first power reverse I ever saw was on a compound Mallet engine. That was the first Mallet coming to my territory. By compound, I mean to compound its steam—use it twice, in the high pressure and the low pressure or front engine. The earlier types of Mallets were the compounds. In those days it was not practicable to operate reversing gear with a hand lever on a double or Mallet engine, because there was only one reverse to control both gears—the one reverse controlled both engines. The Moline or Meline power reverse first coming to the B. & O. looked much like a 9½-inch air compressor, with the reverse head removed. The larger cylinder, the 8-inch cylinder, was used with a valve, to permit the air pressure to move the gear. The cylinder on the other end of the

468 center piece was used as an oil cylinder; in other words they had oil in it, to use it as a cup to take up the shock in the movement of the gear. There were two levers in the cab, the regular manual reverse lever, which was shortened in the cab, right above the rack, and another lever which came down beside that, which set up quite high. You unlatched that to operate the little air cylinder. When you unlatched that, it also pulled up the dog in your manual reverse power, and they both moved backwards and forwards together. That slender or long lever, when unlatched, unlatched the dog controlling the shorter hand lever and it unlatched the other; it also operated our air valve. The function of that cushioned oil cylinder was to take up the shock in the movement of the gear. There was a piston on the oil cylinder, which was mechanically connected to the piston in the air cylinder, so that when one moved, the other moved correspondingly. The oil on either side of the piston in the oil cylinder served as a cushion or shock absorber. It is my personal opinion, like that of the examiner, that the power reverse gear really originated with these first Mallets on the B. & O., and that they could not reverse them by hand which gave rise to the necessity of some kind of power reverse. On account of the two engines being hitched up together, it was impossible to reverse them by hand.

The dog was on the main quadrant, that is your manual and the latch which lifted that dog was on the slender lever; there was a connection at the bottom of that latch over to the dog on the main lever. As to the difficulties we experienced in the maintenance and repair of these Meline reverse gears: We had quite a bit of trouble with the packing in the cylinder; if we got it too tight, we could not move the gear, and if it was not tight enough, it would move
469 by. It was the soft type of packing, with a clamping plate.

We had quite a bit of trouble keeping the adjustment on the long bar in the cab right for the valves which operated the air in and out at both ends of the cylinder. We had quite a bit of trouble keeping the packing on the brass sleeve which came out through the front head. In the shop we had to test the gear out to see whether it was throwing the gear before the engine was sent on her run. We would test it out when it came in for repairs and some time after it had been repaired. Our experience on that was that the air power feature was usually too weak to throw the gear; the packing in the cylinder would be blowing from one end of the cylinder to the other. As I said, if we got it too tight, it created a friction in the cylinder and took all the air pressure to move the power reverse itself, and there was little left to move the engine. There was trouble in connection with the kicking or movement of this long slender lever. In testing these gears, we get up in the cab and throw this lever forward or backward, whichever way you want it to go. Lots of times the gear would hesitate, until you exhaust all the air out, until you exhausted one side and built up pressure on the other, and she would then go over with a bang. That would occur where oil had leaked out of the oil cylinder.

The next type of power reverse coming to my observation was the Ragonnet, type A, coming on new engines, the Santa Fe type 2–10–2, in 1914, weight on drivers, 332,400 pounds. This Ragonnet was quite an improvement over the Meline; it had a slide valve, operating valve, a 9-inch cylinder and a longer stroke. It was also equipped with floating levers and connecting rods, so that it would automatically cut itself out and in, that is, control the air from one end of the cylinder, to the other. The long bar in the cab was done away with, and a short operating lever applied in its place. That eliminated the feature of the oil cylinder or cushion.
470 This Ragonnet had the same type of soft packing air piston as the Meline, which was clamped into place. I had experience in maintaining and testing out that type; I never took any road runs on the engines, but I tested them and operated the power reverse in testing (T. 1734–1743).

I have had experience with creeping on this Ragonnet, type A. It was lost motion where the valve stem was attached to the slide valve, the packing being too tight in the cylinder; lost motion on the connecting rods and links. In those days we received a card stating the work we were to perform on the engine, and it stated

exactly what the engineer had reported on them. I was in the roundhouse at that time, where I got these reports. The general nature of these complaints was "Examine power reverse creeping", "Examine power reverse, not working properly." The first thing we would do would be to test it out. We usually found lost motion or air leaks around piston roads, by the piston in the cylinder.

Ragonnet, type B, was the next power reverse coming to my observation. It was in 1918 to 1920, on a bunch of new Mallets which we received; they came from the factory equipped with this type B, which was one inch larger in diameter, the cylinder, than the type A. There had been a change made in the operating of the slide valve. They used a rocker arm and a joint instead of the valve stem in the type B. The type A Ragonnet had a slide valve also. They both had the same soft packing in the cylinder. After it had aged a bit, we found this type had about the same troubles as the type A. I could not answer from a roundhouse standpoint as to the comparative frequency of reports of trouble and of repairs we made as between types A and B, as they came just about the time I was transferred to the back shop, Feb. 1, 1919. In the back shop, I supervised the work of making repairs and maintaining this type B.
471 In that connection in the back shop we found that soft packing in the cylinder was dangerous at times; we found that under certain conditions. The packing would be clamped so tight in the cylinder that it would hesitate there, and it would go out with a bang under certain conditions.

The next type of power reverse coming to my notice was the Barco, in 1926. We bought them from a power-reverse-gear manufacturer. At that time we were changing over from the compound Mallet to the simple Mallet, the difference being that the compound Mallet takes steam in its high-pressure cylinders and exhausts it through a receiver pipe out of the stack. A simple Mallet takes steam direct from a boiler or superheater into both cylinders, that is front and back cylinders, the same as a simple engine. I personally had nothing to do with determining which type of power reverse would be tried. I supervised the installation of these Barcos on instructions from higher authorities. First we received I believe the B–2 type of Barco. Referring to exhibit 17 and illustrating the difference between the B–2 Barco and the B–4, pictured here: The B–2 had a square extension covering the rack, coming off the piston. The reach rod arms are located a little differently. That is about the greatest change I have seen, or that I notice right here. The Barco is operated by rotary valve. It transmits its power through a piston, a 10-inch cylinder which has metallic rings. There is a rack attached to the piston in the cylinder which transmits the power to a worm shaft, which has a gear on one end and a worm on the other. The power is transmitted through this gear and worm to the wheel, down to the reach rod, where the connecting rod extends out to the link motion. That is a description of that gear as illustrated on exhibit 17. We installed this Barco power-reverse

gear on simple Mallet engines, going out of the back shop after undergoing class 2, 3 and 4 repairs. We had considerable
472 difficulty in reversing engines, and it would take considerable time to break the engines in, get everything well lubricated, and then we had to jack the air pressure up to the limit, 140 pounds, to get it to move over. The first cause of the difficulty in reversing the engine with the Barco is that the Barco has not got the power under those conditions, to move the gear. It doesn't have power at any time, after receiving class repairs on a double engine. That is what I am trying to get at. That is when the engine is first out of the shop. In order to reverse the engine, under those conditions, when equipped with a Barco, it was necessary to have a man stationed in the cab, sometimes several, with pinch bars down on the side and assist the valve motion over. I think there is danger involved in that operation; in case a man would get his bar located in such a way that the gear would go over, it is liable to throw the bar and injure him. This only occurred on the Mallets; that is the only engine I found, she would not throw it over.

The Barco power reverse will creep under certain conditions; you have what is termed thrust plates at both ends of your worm shaft. You have 3 set screws there to adjust these thrust plates, in other words, keep them very neat, keep them as neat as possible, to have a free movement. By neat, I mean to keep a close motion. I have had experience where the two crept with the Barco 2 type. The B–4's are so new we have not had any complaint along that line from them so far. The last B–4's I believe were received about May, 1930, that is the later type, pretty close to a year ago. I am testifying with reference to the B–2 type when talking about creeping. I mean to say that these set screws if not kept properly adjusted allow lost motion in this worm, giving it an up-and-down motion. That is a vertical motion, which in turn allows you to reach rod arm to give you a horizontal motion, which will give you a very bad creeping, owing to the reach rod arm being much longer than
473 the distance is between the center of your reach rod arm shaft and your worm shaft (T. 1743–1753).

With respect to what I said about creeping, there is no mechanical change between the B–2 and B–4 Barcos which in my opinion eliminate the situation in the B–4 type.

The next power reverse coming to my attention was the Alco, type G; the first one we applied was on no. 7156, simple Mallet engine, Nov. 30, 1926. It did not come with the engine. We applied it at the Cumberland back shop, to take the place of a type B Ragonnet, previously on the engine. The wheel arrangement was 2–8–8–0, converted from compound to simple. The Alco was very similar to the type B, Ragonnet, except that the operating valve was a rotary valve instead of a slide valve; it did not have the oil cylinder that was on the Meline. No difference except the valve. On the Alco we had several complaints of power reverse hard to operate from the cab, the lever hard to throw. We found several cases where the valve

stem makes a seal up against the housing, becoming dry, and that made it hard to operate from the cab. On receiving various reports of power reverses creeping, we found considerable lost motion between valve and stem, also packing cups worn out in the cylinder, bad leaks around piston rod stuffing box. The piston or packing on that type was very much like the Ragonnet, type B, except it had a gland with two studs, which had the packing in place instead of a *spaneled* nut. This lost motion in connection with the valve and stem affected creeping; the cross-head, with which your connecting rod is attached, had to move considerably more distance to take up and allow the air, or allow the stem to move the valve, so that the air would enter the side piston it was going toward. Both
the Alco G and Ragonnet B were very much alike in my expe-
474 rience, except the valve was a little different design. We
found a dry condition in connection with the key washer, where it makes a seal against the housing.

The Standard was the next power reverse coming to my observation. The first one was applied on no. 7131, April 23, 1929. I don't know who manufactures it. We bought it and installed it on this converted engine—in place of the Ragonet, type A. The Standard is very much like the Alco, except the operating valve is on the bottom of the cylinder instead of the top; it is a rotary valve. I cannot recall any particular trouble with the Standard excepting on the packing cups and cylinder; I remember renewing several sets of these. I have had no experience in connection with reports about the Standard creeping; the mechanism was all about the same as the Alco, connecting rods, valves, etc. We have only had the Standards since the latter part of 1929; they are on 10 engines in my territory.

Recurring to the Barco and reference made by a preceding witness to a Barco gear on engine 5501, which he said he saw on the floor and disassembled on Nov. 4, 1929, in a roundhouse: That gear was forwarded to me at my back shop and I inspected an drepaired it. The gear was in good condition except it was torn apart, the dismantled and inspected in the roundohuse and held for probably worm and worm shaft was out of the housing. The gear had been assembling of the Barco gear, the worm and worm shaft would be a week before it was shipped into the —. In the ordinary dis-out of the housing. I know nothing of any tendency in this Barco gear with reference to the worm shaft coming out of the housing; only what was reported to me. They wanted to know the reason.
I got a verbal report in that instance from the district master
375 mechanic. We have had experience on this Barco power re-
verse where parts become tight or otherwise affect operation. In fact we have applied the new Barco, type B–4, to a simple Mallet engine and had considerable trouble getting the power reverse, as usual, to throw both engines; made the run from one division point to the other and the power reverse was taken off and shipped back to me and wanted to know why it was intact in this case. It was not disassembled. I found the worm shaft froze—gaulded or

stuck—in the housing. This was a new gear from the manufacturer; it had just made a run one way on a division point, and I had sent another gear out to get the engine back, and they sent the power reverse back intact to see what the trouble was. In this particular case the gears could not be moved; I took a block of wood and drove the shaft out of the housing, and trued it up. We disassembled the whole power reverse, put it in a lie tub and blowed it out with compressed air, put fresh grease, clean fresh grease in all around and assembled it and tested it out and put it on the next engine out of the shop. To relieve the binding, I had to drive it out of the housing. I did not have any more trouble with it then. We did not bill the manufacturer for that expense that I know of; that is out of my line. We had their representative there; ordinarily I would not think that we would have to bear that expense (T. 1754–1764).

On three occasions this binding or gaulding of the worm in the shaft on a Barco gear has come under my observation—all new gears. Inquiring whether there are any other features about the Barco gear which in my opinion are objectionable: On two occasions, coming in for class repairs, all power reverses are removed and sent to our department for general overhauling, and we found a seal that keeps the air out of the worm and the worm wheel leaking very
476 badly. In other words, air from one end of your cylinder, the rack end of your cylinder blowing right up straight through your worm and worm wheel, and escaping through the various caps. That seal is located between the air chamber of your air cylinder and the chamber in which the worm gear operates. In the chamber where the worm wheel operates, there is nothing outside of the two thrust rings on the bottom and the seal ring and the two thrust rings on top. It moves in lubricants. When the seal became defective in the way I stated, it blew the lubricant and created a pressure, and there was no way to hold the lubricant in the chamber. As to what effect that had on the working parts in the worm gear chamber: once in particular we found a very dry condition in in the neighborhood of the worm and worm wheel, where they mesh together. That dry condition causes friction and cuts down your power and causes rapid wear. The cause of the seal being broken is a worn condition. That gear was in service three years to develop this condition, unless it had been off the locomotive at some other point before it came to Cumberland. There is one objectionable feature we had with the Barco on this particular type engine, the simple Mallet carrying a high reservoir pressure—main reservoir. For a considerable period after the engine left the shop, breaking it in in order to have the use of your power reverse. Carrying your reservoir pressure tends to wear pumps out more rapidly than they would be otherwise. It was necessary to carry this high air pressure on this Barco to give it enough power to reverse the engine, both engines. The Barco has not nearly the power that the Ragonnet, the Standard or the Alco have. The Barco is very much simi-

lar, as far as shock from your valve motion is concerned, as the old hand or manual reverse lever. With your worm wheel, your worm shaft clamped tight in the housing, with your reach rod arms transmitting power to your valve motion, it is a solid
477 shock. There is no give. With the other types of power reverse, you have a cushion with air on both sides of the piston, which, if it doesn't move readily, causes a creeping condition, or throw your valve out. When you are hitching up it seems to take care of the shock better than the air cushion. This shock has a tendency at times to give the lost motion in the worm or worm shaft, rather. It would not have a tendency to affect in any way the position of the worm and worm gear in the housing, if it is clamped tight, that is, not tight, but adjusted properly, it will hold itself. If it is not it has an up-and-down movement.

The B. & O. at one time had the auxiliary steam method of operating power reverse in addition to the air. We had a steam pipe coming down from the turret connected into a three-way valve. The three-way valve thrown in one position would allow steam to go to the power reverse, and opposite air. There were effects coming to my observation as a result of the use of steam to operate the air reverse. We have not had any recently. Years back we used to get an automatic break valve, with a leather gasket and needle, and we found the leather gasket burned to a crisp or cracked. That was due to steam getting back in the brake system, that is, getting from the air reverse into our brake system. Using the steam to operate the power reverse generally leaves a dry condition and affects packing cups more or less, moisture. It sort of makes the packing cups swell up and soften considerably. They have not got the life in them as won't make the seal properly. If you had that condition, in going back to air, the chances are that your air would blow right by your piston. It has been sometime ago that they cut the steam feature out on the power reverse; whether it was a result of those conditions or not, I cannot say. It was about 1925 or 1926. I do not know if this use of steam in the power reverse would have
478 any effect on this seal on the Barco between the air cylinder and the worm-gear chamber, not knowing the composition of the seal. I have found some of them badly worn, as I said. I do not think it was because of that feature that it was eliminated. I do not think there are any dangerous incidents to and peculiar to the use of this power reverse feature on a locomotive which would not exist where that power feature was not applied. I have an instance of an engine equipped with a power reverse where there was a sudden movement of the piston and something resulted; on the type B power reverse, one time on a Mikado locomotive the cylinder packing was tight in the cylinder, was clamped in the cylinder, and it hesitated and knocked the front head out of the type B power reverse. No one was in front of it when that occurred, but the head went out with sufficient force to have injured anyone in front of it. I was there. The cylinder packing was tight in the air cylinder and

hesitated and hung, and when it gave away it hit the front head and knocked the front head out of the power reverse cylinder. I have never observed any movement in the valve gears on a locomotive equipped with power reverse, when standing and when there had been no change of the lever in the cab. I have made up from my back shop records certain statements covering costs of installation and cost of repairs and of parts as to power reverse (T. 1764–1774).

(Exhibit 18, Witness McFarland, marked for identification.)

The first sheet of the exhibit is a statement of power reverse gears applied to simplet mallets. It gives a list of 75 converted mallets. It is confined to converted mallets and to our Cumberland back shop and for the period since March 31, 1926. It is the purchase cost only; just the cost of the gears from the manufacturer. The cost of applying it is to be added.

(Exhibit 19, 2 sheets, headed "Cost of labor and material in applying Barco power reverse on EL–1A, EL–2A, and EL–3A mallet locomotives" was marked for identification.)

479 You will notice, first, the cost of reach rod, second is the power reverse brackets applied to the boiler to hold the power reverse itself; next is the cost of the various lengths of pipe fittings and labor to install; next, of applying operating lever and reach rod. That is from the cab down. As to each of those, it shows the cost of labor for installation in addition to the cost of the part; both material and labor. Those 4 figures are to be added to give you the complete cost of installation; the total is $71.11. That is added to the cost of $325 for new type B Barco power reverse, making a grand total of $396.11 complete.

(Exhibit no. 20 was marked for identification).

This one sheet exhibit is material withdrawn from storage department and the time specified to make repairs to Ragonnet type A power reverse gear. There is no record kept as to how many gears we maintained out of this amount of money; it simply represents the total number of parts withdrawn from my store house in the period shown for repair purposes. I do not have a record from which I can state how many of these Ragonnet A power reverse gears I had in that period. I cannot ascertain how many engines we had equipped with this Ragonnet, for there are additional compound Mallets in and out of the shop in the meantime, which would not be on this first exhibit. The same old power reverse was put back on after repairs were made. It was not simple.

(Exhibit 21, entitled "Following for type B Ragonnet power reverse gear" was marked for identification.)

That represents material withdrawn from storage department to make repairs for the Ragonnet type B power reverse at the times specified here, just at our back shop. I do not know how many gears were involved here.

480 (Exhibit 22, headed "Type G Alco power reverse gear and parts" was marked for identification.)

That shows all Alco power reverse gears purchased new the last 3 years, and also the repair parts to make repairs at that time. I do not know exactly how many Alco G power reverse gears those repairs

were made on or those parts applied to. Very few in addition to those shown on my first exhibit, no. 18. That would be very few more than 30.

(Exhibit 23, headed "Barco type B-4 power reverse gear and parts" was marked for identification.)

This shows the number of Barco type B purchased in the last 3 years, along with the repair parts, by which I mean parts withdrawn from store house and used in repairing them, for that particular power reverse. As to them, $325 is the price per gear and the total of $3,575 is the cost of the 11 gears complete. As to why I show repair parts and new gears on the same exhibit: I asked the storage department about that, and they said that was all purchased in the last 3 years; I wanted them for 5 years but it was impossible to get that because the time was limited.

(Defendants' exhibit 24 headed "Standard power reverse gear complete" was marked for identification.)

That shows the number of standard power reverse gears complete, purchases in the last 3 years, with unit cost and total cost. The last half of the sheet, headed "Screw reverse" shows repair parts purchased from the storage department for repairs on screw levers for the last 3 years. That is a screw manual reverse. (Without objection, it was agreed that the word "power" should be stricken and "manual" inserted on that exhibit) (T. 1774–1783).

On the question asked me about the application of a power reverse as a locomotive—the likelihood of an accident there from the application: I meant to say "yes", instead of "I do not think there is." I thought about this answer during the noon recess and discussed it with Mr. Kirby; I mentioned it to him direct.

481 Referring to exhibit 22, headed "Type G Alco power reverse gear and parts": you ask, "Are the repair items that are shown on that sheet the repairs which were made to or include the 30 locomotives which were listed on exhibit no. 18 as having been equipped with Alco power reverse since the year 1926, and also other locomotives equipped with power reverse?" My answer is :" So far as I know, there were some of them that used this material." Those are the only Alcos I have ever come in contact with which have been applied to these engines. So far as I know, the repairs listed on exhibit 22 were all the repairs made in my shop to the 30 Alco equipped engines that are listed on exhibit 18, with respect to repairing the reverse gear. The roundhouse attached next to our back shop sometimes draws material out of the same storeroom we do. Other times this material is shipped line of road to other shops who might need it. I presume there is material from the listing on ex. 22 which did not go into these Alco locomotives in our shop. The items listed on exhibit 22 comprise all the repair items that I know of that went on to the 30 Alco equipped locomotives which are listed on ex. 18.

(No objection being made to ex. 18, it was received.)

"Mr. McLaughlin. I will point out for the record that ther is no cost price given for the application of the 17 Ragonnet reverse gears on exhibit no. 18. There is no objection as to exhibit no. 19."

(Exhibit 19 was received in evidence.)

(Mr. Stevenson said that the information shown on ex. 22 was objectionable as hearsay upon hearsay, but that "if that is the best information which can be given the Commission, we will accept it without objecting to its form, not asking that it be not received ".)

(Exs. 20 and 21, relating to Ragonnet power reverse gear, were objected to on the ground that the witness does not know
482 how many locomotives were repaired from those parts. The objection was overruled and the exhibits received.)

(Mr. McLaughlin made the same objection to ex. 22, with the same result as obtained on exs. 20 and 21.)

No objection being made to exhibits 23 and 24, they were received in evidence (T. 1783–1792).

CROSS-EXAMINATION

I said that with this old Meline gear I experienced the lever going over with a bang; that would be with considerable force. I imagine there is something unsafe about a lever that will do that; in case a man was off-balance it is liable to jerk him, pull him, catch him. The reverse gears on the engines which were originally equipped with the Meline type have been changed to types A and B, Ragonnet. They have not put any manually operated lever on those formerly equipped with Melines. The earlier types of Ragonnet and Alco power reverses have been replaced with a later type of the same gear—with the exception of one. They have. On none of the locomotives coming into my shop have we taken off a power reverse lever and put on manual reverse. I said there was danger when a man was attempting to assist the Barco gear, throwing over one of the Mallet engines by using a crew-bar on the valve motion. If that engine had been equipped with manual reverse I do not think it could have been handled without assistance. The same danger would not be there if you had to assist a manual reverse engine in being thrown over for the simple reason that at times you get over a tight place, and it will go for an instant, a small distance traveling quickly. In my opinion, there is where the danger lies in catching a bar and probably injuring the man. I have never heard of anyone being injured in that particular fashion. Our first Barco appli-
cation to the simple Mallet locomotive was on September 11,
483 1926. Those gears are still on those engines. This dangerous condition exists when giving the engine general repairs in back shop, where your work is fit up need, and the power reverse is not quite strong enough to reverse the two engines. These engines go through the shops once a year, or once every 14 or 16 months;

each of them has been through the shop something like 3 or 4 times. As to how long they will continue to be stiff enough so that they have to be helped in that way: We take them down in what we call our break-in track. Sometimes we run them up and down for several days, lubricating well the valves, packing, and all the working parts on the valve motion, so that we can get them so that they reverse on a normal pressure of air. We do not let them out on the road until that is remedied.

The air pressure that we have in the air cylinder necessary to operate the Barco gear is usually 140 pounds, and that is what we maintain on through-run passenger service. Our normal level country air pressure is carried at 100 pounds, main reservoir, on freight trains. We are able to maintain that pressure all right on passenger trains. There is no reason why we cannot do it on the Mallet freight engines. We have the same kinds of pumps on each engine. In flat country on passenger trains, in through service we carry 110 pounds train line, and 140 pounds in the main reservoir. When steam was used to operate power reverse, that is for emergency purposes only. That protects our power reverse mechanism against an air failure. You can cut in the steam if for any reason the air fails if the engine is so equipped, and they all can be so equipped. When the cylinder head was knocked out of the air cylinder, we were trying out the power reverse, after being repaired. There was a man up in the cab, working the lever. I was on the ground. As I remember it, the piston was a little past the center of the cylinder. He turned
484 the air into the power reverse, threw the lever ahead; it hesitated a while and then went with a bang. I might mention the cylinder head was of cast iron, and it flew a distance of about 15 feet ahead. It was pointing toward the front of the engine. I do not know how long that equipment had been on the engine; it had been gone over and the piston packing tightened up in the cylinder. This was the first time it was being tested. I had a man tighten it up in the cylinder. He tightened up the clamping plate. At that time it was the old soft type of packing; it was clamped up tight in the cylinder. That is the only one on which it happened in my experience. If that packing had been properly set in there, it would not have happened the first time. We now have an improved type of packing compared with what we used 5 years ago; the present type makes a lot better seal and cuts down a lot of wear in our cylinders. I have never observed anyone else, nor have I been injured myself, in operating a power reverse gear. We do not now have the same difficulty in the general maintenance and operation of power reverse as we had in years past; we will have at least 25 percent of what we have; it is seldom a classified engine coming to the back shop, that the power reverse is not reported creeping, or to overhaul power reverse. We would overhaul the power reverse anyhow. On our boiler-wash engines, which are brought in to wash out the boiler, probably we will have 15 or 20 percent of them that will report power reverse, some trouble or other. Anything reported is

taken off in the back shop and gone through, that is, the power reverse is taken off and repaired on the rack. I do not believe we have one-half as much difficulty now as we had, say, 10 years ago (T. 1792–1800).

REDIRECT EXAMINATION

They come in for this boiler wash every 30 days. The maintaining of the power reverse is not my principal job; it is one of them. What I do with the power reverse is principally to
485 maintain it. I do not operate it. I believe that we have more power-reverse troubles compared with what we do with respect to air-pump troubles. It is hard to say how much more; it is a matter of opinion. When we have a power reverse creeping on a road, usually the road foreman and assistant know that is coming to the back shop and report it, and then they tell me verbally to watch out for so and so and say: "Let us get it off in good shape so that it won't give any more trouble." I do not handle the dynamo, but they renew things like that, the headlight, etc. On class repairs, when we get an engine in the back shop, we take all these parts and appurtenances off and put them through a regular routine—not on the boiler washing but on class repairs. And that is regardless of the extent to which they may need repairs (T. 1800–1803).

JAMES A. WARD testified:

I am 54 years old and reside in Baltimore. Am employed by the B. & O. as railroad engineer and was first hired in June 1897 as fireman. I was promoted in November 1905. Prior to this employment, I had no railroad experience. My experience as a locomotive engineer has been continuous since 1905, and it covers locomotives equipped with power reverse as well as manually operated gears. In 1918, I first operated a power reverse gear. Since then I have operated the Ragonet, Alco, and Barco. I have had no experience with the manual screw reverse. From 1918 to 1926, my experience has been equally divided between the manual screw reverse, the manual lever reverse, and power reverse; since 1926, it has been exclusively in power reverse. My experience as engineer covers yard jobs, unassigned through freight, work train, fast freight, and passenger service. At present I am in passenger service, running between Washington and New York, Fort Pitt Special east and Capitol Limited west. We have power reverse gear on both
486 those engines; the latest type Barco. Ranging from 1905 to now, the weight on drivers of the locomotives I operated ranged from 110,000 pounds to 247,000 pounds; the range on those equipped with manual reverse would be the same. The actual weight on those locomotives equipped with power reverse is 201,000 pounds on the drivers; that is the exclusive weight on the drivers of the engines which I have operated with power reverse. I have operated in weights engines the same, equipped with hand reverse

and also equipped with power reverse, but not the same in type. I have never been injured by a hand reverse gear, nor have I seen anyone injured. I have had hand reverse gears go into the forward corner—on the Stephenson valve gear, the type of engine was what we would commonly call a ten-wheeler. Such action on the part of the lever could be caused by a weak thumb or dog spring. It could be caused by the notches in the quadrant being worn or the notches on the dog worn, or grease getting on the notches of the quadrant, and the vibration of the locomotive causing it to work loose and drop down. That last time I had that happen was between 1908 and 1911, but those types of locomotives are not now in use on our division. When the manually operated reverse lever went to the corner, I was not in a position to be hit because I was at the side of it. I sat on the side of the cab, and the bar was at my left [indicating] and it would drop alongside the boiler. On those types of locomotives, the clearance was close, but on the modern ones, we have plenty of clearance. Some of the modern locomotives are equipped with power reverse, but we are running engines of the later type (not that I am operating) which operate with a manually operated reverse gear. That is the lever type. The class I am talking about about is a 462 locomotive; it is a Pacific type engine, passenger engine. On that type of engine, with my body being on the seat, we would have about 6 inches clearance. When the lever is all the way back of the quadrant, it is a foot from
487 the back board of the cab. When it is all the way ahead, the closest thing to it would be the brake valve on some of them, and the closest to it on some of the others, of the same type but just a different placement of the brake valve, would be the boiler head. It is 6 inches away from the boiler head, and about the same distance away from the brake valve on those engines. I weigh 208 pounds. I have never had the hand lever go into the back corner, without me putting it there. I have had a reverse lever thrash back and forth on the ten-wheel type locomotive, the Stephenson valve gear. I have had manually operated reverse gears that worked harder than others, but if it was properly maintained, to my mind there was no great physical exertion attached to operating it. If the quadrant did not fit exactly the slide in the reverse bar, was not plumb, it would cause the reverse bar maybe to bind on the side of the quadrant or maybe underneath it, if it was not plumb. The hard operation of which I speak was an exception to the general rule. The types of power reverses I operated are the Ragonnet, the Alco, and the Barco. I have not seen any that do not creep. There is a difference between creeping and pumping. I have had experience with power reverse gears pumping; on the engine I now operate, no. 5320, with the latest type Barco reverse gear on it, I have had my reverse gear pump to such an extent that I thought it endangered the valve gear and all parts of the power reverse levers (T. 1803–1811).

When they are pumping, it would be nearly impossible to detect just where they were cutting the steam out or in, due to the fact that they take this position [indicating] (showing the witness rapidly moving his arm forward and backward). It would be so quick that you could hardly detect whether it was cutting the engine out or not. That would be just a part stroke, because the lever
488 would not move, only the piston, and the rods on the cylinder of the valve gear. It would not come clear back, due to the fact that the lever would hold it. The effect that the pumping would have on the operation of a passenger train would be such that if it was not overcome immediately with the bar, it might tear the train in parts, or would shimmy the train to such an extent that a person standing in the aisle or sitting down would notice it on the train. By being corrected I mean, if the bar was not immediately moved to overcome the cut-off, we always correct that condition with the bar. Creeping has more effect on fuel and water than pumping has, because when the valve is creeping, it goes always toward the forward motion and then sometimes back slowly, giving you more valve travel, which means naturally you use more fuel and consume more water.

As to how pumping affects the operation of a freight train: If a freight was traveling at a high speed, the pumping would have the same effect as on a passenger train. The momentum of the train would keep the locomotive and train also moving until the valve was dropped and the proper cut-off regulated. If the freight train was traveling at a slow rate of speed and this pumping effect was to take place, I imagine this—I have not operated freight trains. I mean in my opinion instead of my imagination. I have operated a freight train with a hand reverse and also one with power reverse. What I meant to say was that I had not had the pumping effect with a power reverse on a freight train; in my opinion, it would stall the train. To compare the manually operated reverse gear and the power reverse gear as to my ability to hold a fixed cut-off: With the manual gear when you place your locomotive reversing gear in a position, it stays put. The power operated reverse gears that I have operated creep, thereby changing the cut-off at intervals on the line of railroad, or the territory that you are operating over.
489 Based on my experience, I say that a hand-operated reverse gear is more efficient to operate than a power reverse gear. The manually operated would be the safer to operate. A power reverse gear, where there is power, there are always more elements of danger than there are where there is not. If they were putting on a hand gear to suit me, I would ask them for a hand screw reverse. The time required to reverse an engine equipped with a manually operated reverse gear and one with the Alco reverse gear would be about the same; the Barco is a slower gear to operate. It takes about 6 seconds to bring it from the extreme front end of the quadrant to the extreme back end, and vice versa, which means to reverse your

engine backward and forward motion it takes between 12 and 14 seconds. I have actually timed the operation. I have operated a hand reverse both sitting and standing. I have installed a foot rest on my locomotive; it is on the brake pedestal. I keep my foot against it, using it as a brace or foot rest. That is where I keep my foot when I am using the reversing gear. The brace on the hand reverse gear is sometimes differently located. Some of them have a block on the floor of the cab. Others have a bolt at the end of the quadrant. Others have an upright about that high [indicating] on the bottom of the cab floor to put your foot on. When I am operating one of them I frequently have my foot against one of them in reversing the locomotive or in running along. When I am standing I use the foot brace to balance myself, and when sitting to rest my foot against, and for no other reason. I refer now to both types of engine, hand reverse or power reverse. I had two years regular service in yard or switch service with a hand reverse. I have never had any trouble with a hand reverse gear. If the signals were given from in front of me, I could observe them very readily through the front cab door. If they were given from the rear of me, I could look around or sit this way and look out the cab and get them
490 [indicating]. I did not have any difficulty in getting the signals. After operating a manual reverse gear either on the road or in the yard, my physical condition was always such that when I got off my locomotives I could very readily go gunning, fishing, or play ball. As to whether I ever observed any conditions under which a gear moved on a power reverse equipped engine while standing in a terminal: Yes, sir. I have been standing alongside the locomotive that I am not operating, with a Barco reverse, and have seen the die block move as much as an inch and a half in the link. There was no one in the cab to my knowledge. A leaky piston packing will cause it; a leaky packing ring in the air cylinder will cause it (T. 1811–1819).

CROSS-EXAMINATION

I run the Capitol limited between New York and Washington; that is the crack train of our road; the train our company advertises as being 98% on time. In operating that train about two years, I have been late 3 times, and then not over 12 minutes. My company also advertises it as one of the trains where you can sleep when you are riding, and I hope you can if you are riding behind me. The engineers are instructed to handle their trains with safety, comfort, and speed. My average speed over the route is at 45 miles an hour, but I go as high as 85; all with power reverse. As to whether I am always able to correct the creeping and pumping by adjusting my lever as soon as it commences: At that particular place that it happened, I would be able to arrange the reversing lever, after operating it maybe down the quadrant several times until it would get the proper cut-off, and then it would adjust itself. At one particular

place it is only a matter of a few moments to correct whatever condition has cropped up. I have had trips that I did not experience any difficulty in the creeping effect with power reverse to any
491 great extent. Fifteen times from New York to Washington on the average would I have trouble with the power reverse when they are creeping. On the engine that I am now operating with the Barco, on comparatively few of the 10 trips that I make in a month—that I do not complain about the power reverse or report it on my monthly report. About five times, or half the time, I make a written report of trouble. In Jersey City my report reads about as follows: "Power reverse repaired, working very bad." In addition to that, I go to the roundhouse foreman and hold a verbal conversation and explain to him the actions of it, and ask him what he thinks is the trouble. By very bad I mean when it creeps to such an extent that it would change the cut-off from the working position to 6 inches more travel. They undertake to repair and lubricate the gear when I report it. Sometimes they take the head off and examine the cylinder packing. I have not observed them doing that. The next time I get the engine it is in just about the same shape, and I report it again. Out of the 124 round trips I make in a year, I will report the reversing gear 30 times. There are many times it happens I do not report it. I do not report it at this end of the journey, because the locomotive I operate only lays over in Washington an hour and 40 minutes. She is in on the far track, and she is leaving in an hour and 40 minutes. She gets on the ready track in Trinidad Roundhouse at 3:15 and she is leaving the station again at 5 o'clock. As to whether if it was not in a condition to operate, they would send her out: It operated under the same condition. They do not know without me reporting it. We try to have our work done in Jersey City. I do not go as much as a month at a time in Jersey City without reporting it. Most of the months I report it 3 or 4 times out of 10 trips. Two other men besides
492 myself run the engine. Each of them makes about 10 trips, outside of one month we make an extra trip. Those other engineers are Eugene Owens and B. S. Daniels, both living in Baltimore.

I said I would prefer the installation of a manually operated screw reverse on these engines in passenger service. In yard service, I would prefer the power reverse—because I can operate it without changing my seat, more easily. I could operate the power reverse on local freight more easily seated on the seat box than I could the manually operated, at times. The manually operated reverse is a more safe gear than the power reverse gear. The power reverse gear, where there is power there is a certain element of danger from moving parts, such as I have testified to before, which I have seen; the die block may move as much as 1½ inches in the links when the engine has been standing at rest in the house, without any operation from the man end of it at all. In yard service, I said if they were putting on a reverse gear to suit me, I would want a power

reverse gear. I did not speak from the safety standpoint; from the physical standpoint I could sit on the seat box easier than I could otherwise, without any exertion whatsoever in the movement of my body and operate the power reverse (T. 1819–1826).

I stand by my statement that if I was to be suited, I would want the power reverse in yard service. There is nothing unsafe about it to me from the operating standpoint. The unsafe part comes in where the engine is standing in the roundhouse with the die block moving up and down in the link, the reach-rod connection to the tumbling-shaft arm was moving. If a man was working at that time in close clearance about those parts, it might catch his hand,
arm, etc., or any part of his body that would be exposed to that
493 particular part. While the engineer is operating the engine,
there is no danger to him in connection with power reverse. I have never been injured myself nor do I recall a case of anyone being injured when a locomotive was standing and the link moved in the block or other parts; I might have heard of it, but I do not recall such instance. To reverse an engine with a manually operated screw takes 4 seconds. You have to give the wheel from clear forward to clear backward about 8 or 10 turns; 8 or 10 one way and vice versa. That is from complete forward point to complete back point. It takes about 8 or 10 turns to bring it back, and an equal number to put it down. That would be twice eight, 16, or twice ten, 20, one way or the other. I won't say whether it is 8 or 10. I do not say it takes about 8 or 10 to get it back to the center; it takes 4 or 5 to bring it back to center but to bring it clear to the extreme back end of the quadrant it would take about 8 or 10. I have not actually made a check of that. I have never timed myself as to the amount of time it takes me on the screw valve; it depends on how easily the screw operated. I generally use both hands in reversing all locomotives and am doing so on the engine I am now using. I cannot say that is a habit. It is a sort of custom. It is the same as eating a sandwich, a man probably uses both hands to hold it. It is not necessary at all from the standpoint of strength to use both hands. I have had screw reverses that I could operate very easily with one hand. As a general thing, I had both hands on the lever or knob. I have had them in such a condition that I had to use both hands in order to get the wheel turned over. I have a foot brace on the engine, where I keep my foot. When I am operating or not operating the valve, I keep it there. It is not necessary for me to put my foot on that brace to operate the power reverse. I have operated manual reverses where it was not necessary
to put your foot on anything, as far as the physical operation
494 of the gear was concerned. As I stated before, it was the
custom to put your feet some place, and you generally did that. I just do not know why you do it. I have had others where it was necessary to brace myself against the foot rest in order to handle the lever. I said we had locomotives of the same weight but not of the same type that have both hand-and-power reverse in my

district. We have some of those that are hand reversed with the manual bar and some with the screw reverse bar of the same type. Now that is type and of the same weight also. We have some with the same weight that are power reverse. We have very few of the Pacific type engines today with the manual lever on them. We have about four engines with the screw on them, and the rest is power reverse. We have in the neighborhood of 45 engines in that service, speaking of the service I am now in. Forty-five all told. The weight of those engines is 201,000 pounds on the drivers. We have 45 engines of 201,000 pounds on the drivers operating in the service that I am in, the Blue Line service. About 45 of that type and weight in my district. Of that 45, about four are equipped with the manual-screw reverse; while I do not know exactly, there are 2 or 3 of them with the manual bar. I have not operated any except this one engine since 1928. I would say that six would be the outside number with the bars. At the most out of the 45, 10 are manually operated and 35 are power-operated reverse gears. I said in my opinion the hand-operated reverse lever is the most efficient and economical; what I have in mind is that the power reverse is wasteful; both with coal and steam and water. That is my opinion. I did not experience a train being torn apart by pumping. To relate what happened to me: On the train I am now operating, at 8th St., Bayonne, I was traveling at about 65 miles an hour,
495 and my reverse gear started to pump very badly. The lever was working at a point of cut-off about the general way I worked it. The lever would not move. I dropped the lever down four or five notches, 4 or 5 inches, and brought it back, and it continued to pump, and I put it down nearly to the corner, and the pumping started, and I brought it up the rack slowly, until I came to the point of cut-off, and it came along all right, and I got to Elizabeth and made a stop. After I passed Plainfield I broke a reach rod, about 8 inches from the front end of the tumbling shaft on the lifting shaft, which is attached to the tumbling shaft. My valve gear went into full-forward motion, which is natural, and I worked my engine then on into Philadelphia in that position, losing on the run from that point to Philadelphia 14 minutes. There I got another engine. Even when the air reverse started to pump, the operating lever remained stationary. From my experience that is true at all times in the pumping; that would remain stationary. When I moved it, I might have had both hands on it or one hand. More than likely I had one hand on it and looked out the window to see when the pumping effects would stop on the reversing gear. I do not know exactly what caused the pumping; it could be caused by leaky piston packing; piston on the power reverse, causing an unequalization of power in the brake cylinder, or a leaky piston-rod packing—may be that would be plainer. A piston-rod packing or the piston-head packing, air peaking by that. And on this worm, when those notches are fitted on to the worm snug, it would start that vibration of the rod up and down, and as it would move, you would get an exhaust

out of the air exhaust on the cylinder, which would continuously cause an unequalization of pressures until such time as you moved your bar to a greater extent to overcome that, thereby putting a full force of air into the cylinder and moving the valve down. That is the only explanation I can give of it. That air cylinder
496 has a rotary valve. There might be enough lost motion in the valve to cause it to move. It is not noticeable on the reversing lever. I do not know how much lost motion would be around the rotary valve there. It is not lost motion from the lever that we now have, but it is all inside the casing that this effect was caused by. I could not see what was going on there. My valve could have moved without affecting my lever. On that occasion when the reach rod broke, there was no indication of a dry locomotive on this particular occasion. We have a forced-speed lubricator on there, and the engine is at all times very well lubricated. I think this reach rod was fractured in this pumping at 8th St., because 12 miles from there it was broke. That is my supposition. I stopped and looked at the reach rod. It was about 58 percent new break and was crystallized.

If there was an obstruction of any kind in the steam chest, that would not cause pumping. Sticky valves would not cause that sort of pumping. The dry valve on this type of locomotive, on the cylinder type, is very hard to detect, without getting off on the ground and maybe seeing a piston rod that has not got the proper lubrication on it. With the power reverse, it is hard to detect a dry valve. When this reach rod broke, that did not affect anything inside the cab. If you had a reach rod break with a manual bar and the link motion going to full-forward position, then all connection would be cut off between the valve gear and the cab. If there were sufficient strain on the reach rod to break it, that might be reflected on the dog in the notches of the quadrant. It would not affect me. The reach rod is connected directly to the manual lever. The extra strain would not have the tendency to cause the dog to fly out of the quadrant if it did not have a weak spring. If the spring was of sufficient tension to hold it in, it would hold the dog in the notches. I cannot see that there would be a tendency with
497 that extra pressure to force the dog out. If it did not force it out or it did come out at that time, there would be no danger to the engineer. If the engineer had hold of it and the dog jumped out, with a pressure of that kind sufficient to break the reach rod, there would be no danger to the engineer if he let loose of it; if he did not, it could drag him down, bend his back, or cause him to bend his knee, it is hard to tell. He surely would not hold on to the bar if he was going down with such force that it was going to throw him. I know I would not. I would not be taken unexpectedly; I would feel it jerk and would let loose of the bar. It might surprise me, but I would let loose of it. When I demonstrated the pumping with the rapid movement of my hand, I would say the piston in the air cylinder was moving 6 inches. I could not tell at that rate of

speed if the valve would be completely coming over the center or not. The momentum of the train and the occasion would be such a short space of time that would elapse in there before I would drop the bar, that I could not tell whether it was coming over the center or not. You will know when it starts pumping because you will hear the exhaust from the air cylinder. As to what distance the Barco will creep in the extreme: It will change the travel of the valve. The cross-head will creep so that it will change the cut-off of the engine as much as 4 inches. In order to do that the reverse-gear piston would have to move 4 inches—not that much—about 3 inches would let it down, or about 2½. I do not know exactly the travel of the cross-head in comparison to the valve. The piston would creep about 3 inches and at the same time the lever would not move. That is true on the Barco.

REDIRECT EXAMINATION

When I said I had a reverse lever thrash back and forth: I had in mind that if a manually operated reverse lever was to become detached from the quadrant, it would drop to the for-
498 ward motion, and if the spring on the dog was not of sufficient tension to force the dog into the notches of the quadrant, that it would come up and down the quadrant until the teeth, or rather the dog latched into the teeth of the quadrant [indicating]. I have had that on the ten-wheel Stephenson valve-gear engine no. 2056. I can only recall one case of that kind, about 1906. I have never had a reverse lever go from full-forward to full-backward motion and then back again [T. 1826–1842].

499 June 13, 1931

DEFENDANTS' EVIDENCE

DANIEL F. CROWLEY, locomotive engineer for the Illinois Central, living at 559 North Spring Street, Elgin, Ill., age 68 years, testified:

I was originally employed in an engine capacity by the Illinois Central in 1890, and promoted to engineer in 1897, and have been continuously and regularly employed by the Illinois Central since. The services in which I have been employed are switch engine, construction work, transfer work, freight train work from Chicago to the race track, and passenger. The smallest type of locomotive I have handled was 72,000 and the largest 152,000 pounds, which were equipped with manual reverse gears. My present assignment is a short 24-mile passenger run from Chicago to Addison, making three round trips a day. I use one of the little suburban engines, a 17-inch engine with two drivers, all on the one truck, like they used to have on the lake train, suburban trains. I believe the weight on its drivers is 72,000 pounds. There is sufficient amount of clearance in the cab, which is about 9 feet long, I judge, and there is

lots of room between the boiler and the quadrant and the reverse lever. When I am sitting down, there is 6 or 8 inches between me and the reverse lever. This situation has existed with respect to all the engines I have operated, they are all alike and all the same class.

My physical condition is good. During the period of time I have worked with the Illinois Central, I have never strained or overtaxed or exhausted myself by reason of operating the hand reverse gear engines, and have never been injured while operating the hand reverse lever, nor do I remember ever having been present when
500 anyone else has been injured by reason of the operation of the hand reverse lever. I was never injured by the operation of the lever while working around the engine cab doing other work.

My experience has been that some levers operate a little easier than others, but there have been none that I could not get back and forth nicely and without any strain.

While in switch service there were times that I would have to lean out a little bit to see signals given me. This depended upon the position of the switchman and where he would be when he would give his signal. I have had no difficulty in being able to observe signals that were transmitted to me and have always been able to keep a proper lookout when operating my engine and have not had any difficulty in that respect.

During the past 15 years only once was it necessary to secure a helper in the pulling of the hand reverse lever, and that was last winter, the circumstances being that I was stuck in the snow and the trouble with the lever was that I had her full of steam, to try to get out of it back and forth; we were trying to slack it back and forth and they were so full of steam I would have to release it in the cylinder cocks to do it, and when I could not do that against that pressure I would have to call the fireman over. I would say: "Let's get her back and get a little more slack." I would do that two or three times and finally sawed away and we got out of it. That was the only time I had any difficulty within the last 15 years.

I have never had any difficulty in hooking up with one hand while in operation. In operating the hand reverse lever I use either one or two hands, whichever way I find the easiest. If I am standing up I use both hands, and if sitting down I use one. The reason I use two hands while standing up is that there is less strain if you reach over to get hold of her and hook her back, that is when I am hooking up. If I was throwing her clear back I would
501 give her an awful hard jerk and throw her clear back, using one hand. In answer to the question as to what you mean by strain, the witness said: "Well, it would make it easier, you see. There was no strain when setting down to hook her up after we got started, that is, hook her up a notch or two at a time, there is no strain in that. But to throw her all the way back, then there might be a little strain. Well, it might be easier. I mean by putting her all the way back from the front to the back it would be much easier with two hands than it would be with one hand; where you would

have to use a little more strength with the one hand to get it back than it would if you took two."

I have never had a lever pull away or jerk out of my hand after I had unlatched it. During my years of service I only had the lever jump out of the quadrant once and that was about six months ago. The circumstances surrounding that occurrence were that I was coming out on my run one evening, running about 40 or 45 miles an hour and I went over the C. & I. W. railway crossing and it went almost from the center down into the corner. The engine at that time was double crewed. I had the afternoon job and the other boy had the morning job. I investigated the cause of the trouble and found that the other boy had oiled the dog and the latch on the reverse lever so as to make it slip out of the nicks easier and I did not know that. That night I asked him what he had done and he said he had oiled it. To remedy the condition I shut her off and took her out of the extreme corner and hooked her up three or four notches to get her out of the corner. My stop was about four blocks from there. I made the stop and started out, hooked her up, and held the latch on the top of the reverse lever out of the nicks in the quadrant and it was perfectly quiet, and I knew then that it was no dry valves. I wiped out the oil from around the dog
502 and took a piece of waste and wiped the oil from around the notches on the quadrant. I did nothing to prevent that from happening again. That never happened to me since. If I had held on to it undoubtedly I would have been injured. I just let it go down and she went down. I did not have time to do anything, she went down so quick. I did not have hold of her.

Engines that I have operated have a little brace at the front of the quadrant and also at the back called the foot brace or the foot rest, or both. It answers for both. I sometimes use the foot rest or foot brace to rest my leg. There is no other reason for it. I generally use it for resting my foot when running along sitting down. The largest locomotive that I have operated, as to weight on drivers, is, I believe, 152,000 pounds. It has not been necessary at any time for me to brace myself when operating the hand reverse lever. The engines handle easily. I have always been able to maintain a definite and positive cut-off with the manual reverse gears; there are times when I do not touch her at all for 10 or 15 miles. I have no trouble in doing this as I have only got two cars and hook her up pretty well, and the stops are so short I leave her setting in one position and she will always start then. I have found that situation to be the same with respect to runs before the present one, and with respect to work in which I am engaged from time to time.

My practice with respect to inspection of the engine before I leave the terminal is I look her all over to see that all cocks are closed and check the reverse gears. We have several switches to throw before we get out, and I oil her around and I start my pump and my lubricator. By checking the reverse gear I mean I throw her back
503 and forth. I do that when I oil around to spray the oil on her.

In answer to the question, "Do you make any inspection of any kind of your reverse gear before leaving the terminal?" witness stated: "No, only oil her around and throw her back and forth." I make no observation from the ground of the engine or any parts of it.

In my 40 years' or more experience in handling manual reverse gears, I have never found any danger in connection with their operation and I can not suggest any changes that would make them any safer. I have never had any experience with power reverse gears (T. 1843–1853).

DEFENDANTS' EVIDENCE

MILES CRYSTAL, locomotive engineer for the Illinois Central, living at Decatur, Ill., age 38 years, testified:

I was employed by the Illinois Central as a fireman in December 1912 and promoted to engineer in February 1922. With the exception of two years in the Army, I have been continuously and regularly employed in engine capacity. The class of service I have been engaged in is pool freight, mostly switch and transfer service. The smallest engine I have operated is 118,500 pounds on drivers and the largest 296,500 pounds. The 118,500-pound engine is equipped with a manual reverse, the other locomotive with power reverse, which is a Ragonett. Part of the time I operated engines as engineer, and the other part as fireman. My present assignment is as a fireman. In handling manually operated engines, I found that there is sufficient clearance in the cab.

My weight is 198, and my physical condition good. I have never had any experience with respect to straining myself in the operation of engines equipped with the manual reverse gears. Neither
604 have I ever felt overtaxed or exhausted after a day's work or after one of my runs. In operating the manual reverse gear, I use one hand and sometimes two. I have never received an injury while operating the hand reverse gear. Neither have I been in an engine when anyone else was injured while the hand reverse gears were being put into operation. At no time while the hand reverse gears were being operated or while I was in the cab and no one operating them, have I, or anyone else, been injured.

I have been on an engine equipped with power reverse gears when a person has been injured. That occurrence took place May 3, 1929, at Decatur, Ill., at 9.25 p.m., while the engine was at a stand-still. The injured person was D. W. Boggs, an engineer, who was dead the next day. At the time the accident happened I was in the cab of the engine trying to prevent a hazard of accident. We had stopped to take water at a pen stock on a curve. A train was backing down. I saw it about 14 car-lengths away and jumped off the tank. The switchman was in the cab and I told him to tell the engineer. The switchman began hollooing to the engineer. I rang the whistle, then threw the bell on, and threw the reverse lever in forward motion

as a preliminary move. The engineer was on the ground on the left side of the engine. I do not know what he was doing. I was in the cab on the right-hand side. Immediately after pushing the power reverse lever I discovered that an accident had taken place and jumped to the ground to see what was wrong. The switchman had said, "There's something wrong." I jumped on the right side of the engine and observed that Mr. Boggs' head was caught in the valve gear, between the radius rod and the main reservoir. His feet were touching the ground. The space between the radius rod and the main reservoir while the reverse gears are operating has a minimum of 4½ and a maximum of 8½ inches. I went to Mr.
505 Boggs' assistance and told the switchman to reverse the gears, which he did. That released the space between the radius rod and the main reservoir. This accident occurred on engine no. 248.

I have had some experience in operating an engine equipped with what is known as a Precision reverse gear, but not very much. It was just an emergency trip caught in pool freight. From my experience there is a difference in time between the time it takes to reverse an engine equipped with Precision gears as against an engine equipped with the lever or the Ragonett. I can not state the difference in time. From my experience there is a difference in time in the movement of the manual reverse lever as compared with the Ragonett or Precision type of power reverse levers. The Precision takes longer than the other two, but I can not tell the time. As between the manual and the Ragonett, I could not tell the difference; that is, I do not know what the difference is.

Some manual reverse gears operate a little stiffer than others. Steam in the cylinder in cold weather will make a difference in the operation. In the operation of the power reverse gear, after you throw the lever on the Ragonett type, I can not feel any obstruction of any kind in the valve gear parts. With the manual reverse gear, while you are either pulling or pushing the lever, it is possible to feel an obstruction and from my experience it is my opinion that I could have felt an obstruction had the engine on which the accident occurred been equipped with a manual reverse gear. After the accident I operated the engine in switching service for about four months with the same gear and still equipped with the power reverse gear. In answer to the question as to whether he had ever felt an obstruction in the valve gear with the hand reverse gear, the witness answered, "No."

506 The hand reverse lever is sometimes harder to operate than at others. In response to the question as to whether after you throw the lever on an engine equipped with power reverse gears, there is any way in which you can prevent the gears from moving to correspond with the position of the lever, the witness stated, "When you move the lever to the extent of the quadrant, that moves the valve to the extent of its position and the gear follows right on down."

With an engine equipped with hand reverse gears, while you are moving the lever to the far corner, you are in a position to check the movement at any time that you so desire. With respect to the Ragonett type, when you move the lever the valve moves to the same extent, when the piston has moved to correspond with the amount the valve was moved in the Ragonett gear. As to whether you can reverse after you have thrown the lever over and the power gear has started to operate, I don't know. With respect to the comparative safety of the power reverse gears versus manual reverse gears, I was never injured and have never seen anyone else injured with the manual reverse gears. This accident referred to happened with a power reverse gear, and my opinion in the matter is based upon this one accident (T. 1854–1871).

DEFENDANTS' EVIDENCE

C. P. McCaskill, locomotive engineer for the Illinois Central, living at 1147 Minna Place, Memphis, Tenn., age 56 years, testified:

I weight 175 pounds, and have been employed in engine service with the Illinois Central since 1913. Prior to that I was employed in engine service with the Kansas City, Memphis, and Birmingham and also the Frisco for about 16 years. I was a
507 fireman on the Kansas City, Memphis & Birmingham until 1899, when I was promoted to engineer. My employment with the Illinois Central has been as an engineer. My engine service has been continuous and regular except for three months when dismissed from the Frisco; that gives me practically 32 years engine service. I fired on switching engines and in freight and passenger service, after which I was termed a switching engineer. I have not run engines in all classes of service. Employment with the Illinois Central has been in yard service and the breaking-in of engines. I have handled all types of locomotives, the weights on the drivers being 218,600 for the Mikado types and 166,000 for the yard engines. All of these engines are equipped with power reverse gears. All of my experience has not been in operating the power reverse gear engines. From 1913 to 1922 I operated on the Illinois Central engines with manual reverse.

My present assignment is breaking in passenger engines equipped with power reverse. I first started breaking in engines in 1918 and broke in Pacific and Atlantic types as well as the little 5,000 class of engines, which were equipped with manual reverse. From 1918 to 1922 I tested and broke in both manual and power reverse engines. My duties in connection with the breaking-in of engines is to wear the bearings down to get the engine ready for service to make the run. I am supposed to check and watch all parts of the engine, including the gears. When they first come out of the shop, engines equipped with manual reverse gears are hard to handle; they are stiff. I get them lubricated and the breaking-in for service takes anywhere from three to four days. I have not had any serious

difficulty in handling the manual reverse, which I operate with both hands. There is not enough physical strain to hurt myself in operating the manual reverse.

I had an accident while handling an engine with a power
508 reverse gear, the circumstances being that I misjudged my speed in following another locomotive too close. The engine was popping and I could not tell the exhaust from the lever, and I reversed the engine too quick and it did not catch. So when I gave it steam with the throttle it ran into the other and broke the drawbars off the engine. By saying I reversed too quick I mean the links stayed in forward motion but the lever came back and over traveled the valve. That is, the lever came back in back motion but the links stayed in forward motion, which means that when I pulled the reverse lever over the power gear itself did not operate. I have not had an accident in connection with the operation of a manual reverse gear, nor have I ever seen anyone else injured in the operation of the manual reverse gear.

In operating a manual reverse gear engine in switch service, I have no difficulty in receiving signals either from ahead or to the rear, nor have I ever found it necessary on any of my regular jobs to call for a helper to aid in throwing over the manual reverse gear. That, however, does not apply to the breaking-in service. In such service, when the engine is stiff and just out of the shop, I have called a fireman to help me pull it back with the manual reverse gear. I have not had any difficulty in hooking up an engine with one hand while running, that is, on my regular run. You can't do it on the breaking-in service. Just once did I have a manual reverse lever jump out of the quadrant; that time it went to the corner and started back and caught about three notches from the corner. I do not know the cause and did not take any steps to remedy it. At the time this happened I was sitting on the seat. There was no possible chance of my being injured by reason of this action of the
509 lever although it went down in a hurry and with a bang. In operating an engine I put my feet on blocks in front of the seat, which are called the foot rests, and keep them there while sitting down. I have no other use for those foot rests. I have always been able to maintain a definite, positive cut-off with the manual reverse gear without any difficulty.

In inspecting an engine I look at all parts and then move the lever to see whether it will be reversed from front to back corner, and see that it is in good shape before I leave the roundhouse. On an engine equipped with manual reverse gear I can see the reach rod and the tumbling shaft, and by inspecting them can tell whether the reverse gears are in proper condition or position. With respect to power reverse gears I can see all parts except the cylinder which is under the running-board. I cannot see inside the cylinder. I have had some creeping with respect to power reverse gears. One time I was on a transfer run between Memphis and Nonconnah, about 5 miles, and I had the power reverse. On leaving East Junction I hooked up

the engine and it stayed there a few minutes and then dropped down again. It would come back so that it almost cut the exhaust off where it did not handle the cut I was handling. That happened before I went to breaking in engines in 1917 and 1918. The engine on which it happened was equipped with a Ragonett power reverse gear. The present types of engines are equipped with the Ragonett and Precision types, but the present Ragonett is not of the same type as the one involved in the creeping which I have mentioned. The present is a later type, which has only one gait to pull them over, it being very slow. The other type you could pull over with a bang. This is the only experience I have had with the creeping of a power reverse gear. As to the relative efficiency of operation of the power reverse gear and the manual reverse gear, well, the manual reverse gear will hold where you put the lever. I haven't had any experience
510 for the past 12 years except with the power reverse and all of them new from the shop. Of course, they do not creep, but the power reverse handles hard out of the shop, the same as the manual reverse gear. You have to break in the power reverse gears the same as the manual reverse gears. Before releasing the engines that I have under test and breaking-in, they must be in condition to make a trip; I see that all the moving parts of the engine are receiving proper lubrication and are working smoothly. No engines are released until they are in that condition (T. 1871–1886).

G. C. Buell, locomotive engineer for the Illinois Central, residing at Baton Rouge, La., age 67½ years, testified:

I was employed in engine service in 1887 and have since been continuously and regularly employed. I was promoted to engineer in 1891, since which time I have been employed as switch or yard engineer. I work chiefly in the yards, which work I prefer to anything else. I have handled engines weighing from 84,000 to 142,000 pounds on the drivers. Two of these 142,000-pound engines were equipped with power reverse gears. The smaller engines, that is, the 84,000-pound ones, were equipped with hand reverse gears; they are now out of service. The next engines are 118,000 pounds on the drivers and are equipped with manual reverse gears. We have only two engines "down there" with power reverse; they are the 142,000-pound ones.

My experience with power reverse gears has only been during the past 60 days. Prior to that I handled manual reverse gear engines exclusively, with weights on drivers of 118,000 pounds.

My physical condition is good and in operating manual reverse gears I have never strained, overtaxed or exhausted myself. Neither have I been injured while so engaged, nor seen anyone else so injured. With respect to the ease with which manual reverse
511 gears operate, I just sit down and tip my engine with one hand, when I am switching ahead. When I am switching back, I stand up, look back, and use my right hand; I just catch it and throw it either way with my right hand. I am standing up altogether when switching back, and sit down when switching

ahead. I usually use only one hand in reversing and have never had any difficulty in receiving signals either from the front or rear. I have never found it necessary to call for assistance to throw the reverse lever. I have never had the fireman on my side. Only once did I have any difficulty with the lever pulling or jerking away after I had unlatched it, and that was because there was too much oil on it and the little set screw that handles the lever to go where the dog goes through caused the lever to rock a little bit. It just dropped down. I tightened that set screw up and held the lever steady and never had any more trouble. You see, on the switch engines we hardly ever hook the engine up, the switches are so close together, and we do not have any length of yard to go. We hardly ever hook the engine up over the third notch from the end. I was not endangered in any way by the lever dropping. I was in the clear all the time and have always found plenty of clearance in the cab. I was never cramped. When the lever went down, it just dropped as it was only three notches from the end. The engine was working a little hard and it just dropped over because of the set screw dropping loose. It jumped out of the quadrant. I have never had any experience with the lever pulling away after I had unlatched it.

As to foot rests, well, at the front of the quadrant there is a bolt which sticks out where you rest your foot while sitting down. I use it just to rest my foot, as the seats are up high and if you don't put your foot on it, the foot does not touch the running board at all. I don't have to brace myself when operating the manual reverse
512 gears. The engine that I had I kept lubricated and everything in such shape and the counterbalance in such shape that she just tipped over like a pair of scales. I never had any trouble at all. I always adjusted my counterbalance spring myself. My experience during the past 60 days with the power reverse gears has been that one of the engines would handle pretty hard. It handled harder than my regular engine with the manual reverse. It had just come out of the shop, but I have been able to handle it all right.

When operating the manual reverse geared engines I felt all right after my day's work, but while operating engines equipped with the power reverse gear, well, if I had any more time to switch up on the capital and then I had been switching there, I would not be able to get off. It is the position I would have to be in in reaching around and twisting. It gives me pains. With the manual reverse lever I can stand up and look back and be rested all the time. With that lever I can be in a straight position. I cannot stand up and operate the power reverse lever. There is a platform and there is no room to stand up. The pains that result from the operation of the power reverse gear are around the shoulder. I have to twist and reach for the power reverse. The State capital is being built and the tracks go around it, and some places it does not clear the corner of buildings much. The switching is ahead. That is the only reason they have these two power reverse engines, on account of the heavy

switching job. They did not want to have any delay on account of the smaller engines handling the gravel and the heavy steel for the building, so they sent these two engines for that purpose. With respect to whether it is less difficult in switching operations to handle a manual reverse gear engine than a power reverse gear engine, well,

513 I asked the foreman to let me have the smaller engines because it was more convenient and I had more comfort on them than on the big one, and he told me they could not do it because there might be some delay in handling the material on the hill. The contract is supposed to be completed at a certain time and they did not want any delay put on the railroad on account of handling the material, and under those circumstances I would have to handle the big engine, but as soon as that is over they would give me the small engine back in yard service. The small engine is more comfortable and easier to handle. I feel better when I get off after handling one with manual equipment. The reason I wanted the small engine was that I could sit down at times and I could stand up at times. Whenever I would stand up it would rest me. When I was switching ahead, I sat down. When I was switching back, I stood up and that rested me. There are no other reasons for wanting the smaller engines (T. 1886–1896).

G. C. BUELL on cross-examination testified:

I have been employed by the Illinois Central for 44 years and will be eligible for a pension when I reach the age of 70, that is, in 2½ years. I was born in 1864. The engine about which I have been testifying, that is, the 118,000-pound one, we have been running about 4 or 5 or 6 years. It has been in service quite a number of years, although I don't know exactly how long. They arranged to give me a regular engine, and the reason why I can operate this engine so easily is that I know everything about the location of the appliances and am thoroughly familiar with them. As to whether it is kept up in the proper shape, well, we have four or five of them and they are the same class engine, and they are all in about the same condition. I run them all occasionally. Whenever they have a wash-

514 out, that is, wash out the engine, or have a boiler inspection, then we take one of the other engines. That occurs about once a month or so. My testimony is based upon my experience mostly with the one engine that I use. With respect to the power reverse engines, we have had them about 60 days, and we have the two engines on three or four jobs; they are doubling all the time. I am not at home on that engine. The reason I cannot stand up and operate the power reverse on the big engine is because the deck is all filled up with platforms under there. They have platforms built up and we have some engineers that wanted platforms so their feet can rest on it. They do not have the same kind of platform on the smaller engine. As to whether it is the fault of the platform and not the power reverse, well, I never paid very much attention to the running-board of the cab, whether it comes up as

high or not as on the others. On the engine I am running there is one where the boiler comes pretty close to the end and you can stand in there. You can stand up and lean right in the window. As to whether I could handle it just the same if the power reverse mechanism were located in the same place that my hand reverse is located, I don't know whether I could or not, because it is a different type of engine. The boiler head and everything is altogether different. I don't know how it would be. I have no objection to the power reverse. It is the position in which the power reverse is placed that is objectionable. With respect to my statement that I never called upon the fireman to help throw the reverse lever and that I never had him on my side, he hardly ever comes to my side. I do all my switching. I handle my engine and do all switching. The fireman does not do any switching for me at all. I have a colored fireman. You see, the runs are divided up, and on this run it is allotted to a colored man. Two of them have been pensioned since they have been with me (T. 1996–1900).

515 W. K. RUST, locomotive engineer for the Illinois Central, living at Baton Rouge, La., age 64 years, testified:

Since 1885, I have been continuously and regularly employed on the Illinois Central in engine service. I was promoted to engineer August 14, 1888. I have been employed in all classes of service except switch engine, that is, in work-train, freight-train, passenger service, and mixed trains. I have handled every type of locomotive, mostly 30,000 pounds, to Pacific type of engine, which I think is 147,000 pounds weight on the driver. These engines are equipped with both manual and power reverse. The manual reverse is on all the small engines up to the Pacific type.

My present assignment is on a mixed train operating between Baton Rouge and Covington, La. I am using a 500-class locomotive, weight on drivers 147,000 pounds, and which has power reverse.

On the engines equipped with manual reverse gears I have always found sufficient clearance in the cab.

As to my physical condition, I have never had an injury in my life, and, according to my recollection, I have never strained or overtaxed myself in operating manual reverse gears. I have never been injured nor seen anyone injured while operating a manual reverse gear. All my experience has been on a small engine with the manual reverse gear, and I have never had any trouble. I have had engines that I handled with all ease. As to weight on drivers of the small engines, well, I will have to ask for the information as to the 2300 class, which was the largest class I ran in service with manual gear. The largest engine with manual gear was 95,000 pounds. I have never had any difficulty on these engines to observe signals that were given me. I have never had to call upon a fireman or a helper to throw over the gears during the past 15 or 20 years, except when breaking in a new engine, and that was in the days when everybody

had his own engine and broke it in himself, which was up to
516 15 years ago, I suppose. During the last 15 years, I have not had that experience. I don't know that I have had any particular difficulty in hooking up my engine with one hand, while running. Sometimes I would use two hands, but as a general practice I hooked my engine up with one hand. I used two hands just as a matter of habit, not necessarily essential that I use two hands, but I sometimes use two on account of the fulcrum being too wide apart, so I can't span it with my hand. That is one reason I would take two hands. With respect to the lever pulling away after I had unlatched it, well, I think I have had them drop down once or twice. That happened a good many years ago in passenger service. It has not happened in recent years. When it did occur, nothing happened, it made a little noise. I was not injured in the least by it dropping down. I don't know that I have had the lever jump out of the quadrant. On the manual reverse gears engines we generally have a little footrest at the end of the quadrant, and sometimes I usually put my foot against it as a brace to pull the engine up to keep from losing my balance on the seat. You can keep an accurate cut-off with the manual reverse gear without any trouble. My experience in operating engines with power reverse gears has been in the last few years in passenger service and some in this mixed-train service. I have not been able to maintain a fixed point of cut-off with the power reverse gear. The trouble has been a creeping, especially on the light power engines. I had considerable trouble with it on one engine. My experience in the past three years has been that such trouble generally lasts until the completion of a trip. I have no idea of how many trips I have had that difficulty. As to whether it was many or few, I would say it was hard to determine whether it was a few. It was a daily run and I had it happen on quite a number of different days, but not continually. From my experience, the most efficient results are with the manual reverse gear. I have had con-
517 siderable trouble with the power reverse gears pumping; while no accidents happened, I couldn't get high speed with the class of engine I had, with the short cut-off, without going entirely out of gear. This pumping happened very, very often.

W. K. RUST, on cross-examination, testified:

I have been using the power reverse gear on and off for the last 12 or 13 years. As to the percentage of engines equipped with manual reverse or power reverse, well, the power reverse that I used was generally on the Pacific class of engine, but it was in a different class of service. They were in passenger service * * * the Pacific type of engine. I would not say that three-quarters of the engines I have had were equipped with power reverse in that time, because I have not been in that particular service.

With respect to an estimate as to how the time has been divided between the power reverse engines and the manual reverse engines, well, on account of the change of runs that I have gone on, I gave

up the passenger run and took a run that was on a branch line in 1919. There I had manual reverse altogether for about 5 or 6 years. Then we got a class of engine that changed from manual reverse to power reverse, but usually a manual engine. Then I got off that branch run on account of change of schedule and went back into passenger service with a class of engine with manual reverse, between New Orleans and Baton Rouge. That was in passenger service, the 5,000 class. Then they changed that run and put a power reverse of the Pacific type on it, and I went back on the mixed run on the branch with an engine with power reverse on it about three months ago.

The heaviest engine I have used either on the branch or on the Baton Rouge run was 95,000 pounds, with manual reverse. We don't allow a heavier engine over that branch, because of the bridges over certain rivers, and all the power reverse and sized engines on that district have been 95,000 pounds. As to the creeping on the engine referred to, I think I reported it at the end of the run on a
518 written form. I don't know whether it was repaired by the company. The next time I had the engine, it would not be all right, not always all right, because I never was successful in keeping out that pumping, at least. The creeping was remedied. I would not have that for some time. The pumping was on the same engine that crept, and that experience was confined to the regular engine I had on that run, no. 5063, type 4–6, a 10-wheeler, it was a 4–6–0, and, if I am not mistaken, the weight on drivers was 122,000 pounds. I have changed these light engines so often I can't keep them in mind. This engine had a Ragonett type of reverse gear which was on it when I got the engine about 3 or 4 years ago. The last time I ran that engine and it pumped, was, I think, about 4 months ago. I have not had the engine since. Starting with the 4 months ago, when I said the engine pumped, I couldn't say how many times I had that difficulty in the month preceding, because I quit trying to run at high speed with the engine in short cut-off just simply to stop the pumping. I don't know how many times I reported that engine in a month, and I don't know that I reported it on the written reports. I often said something about it. I never had my train delayed or lost any time on that run on account of pumping, and have never been hurt in any way with power reverse.

With respect to putting my foot on the footrest to keep from losing my balance, it wasn't because I needed the strength to do it. I just sometimes put my foot out that way (illustrating), to keep from pulling myself off the seat-box, as any kind of a pull off the seat would cause you to lose your balance. If you sit on a pivot, you get merely a rocking position. The pull would not be enough to pull me off the seat. I would put my foot on the brace just to keep from bending over. If you put your foot on the brace, you do not have to bend. I did not have to bend over to pull it like a man sitting here, and if you sat over here and reached up with your feet of anything, you would be able to pull yourself off the

seat this way (illustrating)—not entirely off the seat, but
519 you would lose your balance. If you had it out there, you would reach over and get it without any strain (indicating). If I did not put my foot on the brace, I would pull it up without it, maybe just leaning over. I might put it on the brake valve or on the side of the cab, but it is not necessary. That is just a convenient spot. More generally in going ahead I would pull with my left hand. I would not pull with my left hand on every engine in an easy fashion. I would do that on the regular run, when I kept a regular engine and kept it lubricated. I could nearly always handle it with one hand. There were probably some occasions when it was stiff, and I didn't do it with all the ease I did on my regular runs. There would be occasions when I would have dry valves and it was because it used to stiffen up a little. There would be occasions when I would try to reverse with steam in the cylinders but that was seldom, unless the engine was standing still, which could be released by opening the cylinder cocks. I generally have time to do that. If the occasion is such I couldn't move the train, I had time to open the cylinder cocks and release it. On freight runs, if I couldn't move the train on account of having to take the slack, I had time to open the cylinder cocks. I have done that at stations on the road, but not usually in front of a passenger station where people were around. I was usually particular that I did not open them on to somebody. I have had to use two hands on some of those occasions, and it is probable that there have been occasions when I had to use a footrest or the injector or something else to give me strength. And it is probable that there have been occasions when I attempted to hook it up that the lever would pull hard on my hands, but I don't think I ever experienced any particular difficulty such as to strain myself. There have been occasions when I had a heavy pull on my hand, when I tried to hook it up (T. 1900–1616).

520 June 15, 1931

ERNEST C. RICHTER, locomotive fireman for the Chicago and North Western Railway Company, residing at Milwaukee, Wis., age 42 years, testified:

I was first employed in engine service by the Chicago and North Western Railway Company in December 1909 in the capacity of a locomotive fireman. I took examination for engineer in 1913, since which time I have been running an engine about 10 years or a little better. I have been running in all classes of service. I have operated all types of engines except the "H" and one class of switch engine, that is, the 2600's, that is, the M–3 and M–4's. During the past 10 years I have operated hand lever equipment one-half of the time and power reverse one-half of the time. At the present time I have been firing for about 6 months. I was set back from the engineers'. board. I have had no experience whatever with a hand lever jumping out of the quadrant, that is, becoming unlatched and going

to the corner, neither have I had any experience with the hand lever slipping or pulling away after I had unlatched it. I have not had any difficulty in handling the hand levers; nor at any time have I called anyone to assist me in order to throw the engine over or reverse it. I usually operate the hand reverse lever with one hand. I do not necessarily have to use two hands. The use of the hand lever has had no effect upon me physically. I have had no experience in breaking in locomotives, and I do not believe I have had any experience with locomotives that were newly out of the shop. I have never been injured by reason of the hand reverse lever or in operating it in any way, or seen anyone so injured.

With respect to the operation of the power reverse gear, I have had various engines creep. By that I mean, while running along at a moderate rate of speed, the reverse gear would creep
521 down 2 or 3 notches and then gradually work its way back, and that experience has extended over a 10-year period. I have been on the extra board and have had different types of engines, in fact, a different engine almost every trip, and the majority of the engines would creep more or less. With respect to my experience with the power reverse gear, in cases where I decided to adjust the valve motion—the so-called hooking-up process—I had in one instance a case where I was trying to hook up an engine and while hooking up I used both hands, while I used the air reverse and went to hook this particular engine up, I had to give her three notches before she responded to the air, and when she did respond she put the lever back in the backward motion and the result was that the train bunched. Before I got her back on the forward motion, she took more than I intended to give her and I got a drawbar one-half way down the train. The emergency operation on the train took the drawbar out of the tender. By getting a drawbar, I mean the train parted and broke the knuckle. This parting of the train had an effect on the drawbar of the tank in that the emergency application taking effect from the farther end, it gave the engine the chance to take the slack before the emergency was applied on the engine, and the strain was so great it broke the eye out of the drawbar on the tank. This occurrence took place between St. Francis and Belton, going to Butler. I have been referring to the rear drawbar on the tender. This all happened, I think, about 2 years ago.

With respect to experiences where the lever has moved several notches before the air would take effect to move the valve gears, I have had several engines that I have had to move the lever two or three notches before she would respond or the air would respond to cause any operation of the lever. When the air did take effect
522 it would take about as many notches beyond what I intended to give her. I used to give her three notches and when the air would take she would probably take two or three more. This would cause a severe strain on the drawbars. The way this would happen is, if you are hooking up and do not take right away, she will probably bring it back to where she cuts herself off entirely, prob-

ably a little bit in the backward motion and then goes forward again. During this operation she allows the slack to bunch itself a little. As a rule I use two hands in operating the lever on the power reverse gear, the reason being that I have not been able in a great number of cases to operate that lever and have it take effect where I could release the latch with one hand, and I use two hands to guide the lever. The lever of the power reverse-geared engine requires a little more attention than when operating with a hand lever.

As to what I do on those occasions which I have described where the lever would take two or three notches more than I intended, well, I am hooking an engine or dropping an engine, I use two hands and keep watch just exactly what my lever is doing, and when I give her one notch or two notches and do not get any response on the air cylinder, I naturally give her more until such time as she takes the air. Then I release, and being that she has not taken air for two or three notches, when she does take the air she takes it in such volume that she takes it beyond the notches at which I have got it set. In those cases, lots of times I grab the lever and bring her back to where I started from to keep her from going way down in the corner. I have had that happen to me quite frequently, four or five times a month. As a rule the engine that it happened on acted that way during the entire trip.

An instance at Proviso yard on a 2500 class J engine was
523 that I came to work to go out on my run and the lever was in a straight up and down position. I oiled the engine. She happened to be standing right, so that I could oil her, and when I was ready to go, I told the brakeman to open the switch and let us out of the ready track. I started to throw the lever in a forward motion and she did not take until practically half way down to forward, and then when she did take she took so much air she jumped right out from under. I use that expression "jumped out from under" to indicate that the engine starts over suddenly. I have the throttle cracked just to start. I did not have the throttle open before I threw the reverse gear over; the cylinder cocks were closed at the time. The expression "cracked the throttle" means slightly open. In this instance the engine jumped before I opened the throttle. I could not say whether the throttle was leaking. It was not leaking when I used her over the road. As to having enough steam in the cylinder, the engine had just been brought up from the roundhouse and it had not been there but two or three minutes and possibly the engine dispatcher had left her that way with steam in her cylinders. There were no cars attached to the engine. I have always been able to keep a lookout with a hand-operated lever and have experienced no difficulty in that respect with an engine equipped with a power reverse gear.

My experience with freezing in connection with the power reverse gear was that I had a 2500 engine going on a stock extra from Butler to Chicago, and my first stop out of Butler was 35 miles

away at a place called Bain, to take water. When I stop—of course, we stop and as a rule cut off and go down and take on coal and water. When I stopped I could not reverse the engine. I tried once or twice and there was no response, so I said to the fireman:

"I am going down on the ground and see what is the matter.
524 When I get down there, be ready to move her when I yell to move her." When I got down on the ground I tried to move the lever and got a little response out of the lever, but there was no response to the valve gear or to the brake cylinder. I noticed ice handing down on the side of the brake cylinder or power reverse air cylinder, and I surmised then that the reverse gear might be frozen. So I made a big torch and started to thaw out the reverse gear. First I thawed out the two little drain plugs and got them open, and in a few minutes I had the water running out of the air cylinder—probably in the course of five minutes or so—and the fireman said, "She's taking." I could see then that she was starting to move. I thought I had her all drained out, but of course before I did this I had shut off the air. When I got the thing thawed out I told the fireman to move her and put on the air. When he moved her and there was no more water, I shut her off and went about my work, got coal and water, coupled on to my train and went to a place called Blodgett, a distance of about 27 miles. I had the same experience at Blodgett. At the time the temperature was below zero. When I refer to the brake cylinder, I mean the air cylinder on the power reverse gear.

With a hand lever I know just exactly what my engine is doing at all times and with an air reverse I never know. With a hand lever I have direct communication from the lever right to the valves, and with the air reverse I have not. When I use the hand power lever I know just exactly where my engine is set and I know just what point of cut-off she is working at. I know when I put it at a place it stays there. I have had very little experience with lack of lubrication on the valves. I have had such experience on power reverse and I have had it on hand levers. I cannot discover such lack of lubrication as readily on the power reverse as I can on the

hand reverse. That is explained by saying that with the
525 hand reverse the lever has a certain amount of noise, and if your valves should happen to get dry it would cause a little more, would cause the engine to pull on that lever a little more than ordinarily, and it would increase the noise on the lever. The pull on the lever causes the noise. I explain this noise by saying that when the engine is running along you get a jiggering noise, and then if your engine gets dry it would be just a—the noise would be greater. There is a jiggering noise with hand reverse levers, with the best of levers, which is caused by the vibration. The noise results from the jiggering. The jiggering is caused by a long reach rod and the carrier not carrying the reach rod properly. Some of our engines are equipped with a reach-rod carrier. My reference to the reach rod means from the reverse lever to the valve gear, and

the sort of movement that I refer to means that the reach rod being so long that it wobbles sideways more than it would up and down. Of course that reflects the movement back on the reverse lever. The jiggering noise is caused more by the latch on the lever itself. The latch is not solid. The latch is on there loose and it has a pin through it and a cotter key, and that latch is not tight. If it was tight it would be hard to unlatch, but it is on there loose and that latch rattles. When I say "the latch" I refer to the little handle that you have with the reverse lever that unlatches the dogs out of the quadrant. The dogs is a little casing that has teeth on it, that is set in with the teeth of the quadrant. With respect to the end of the lever, this latch is located right at the top where you grab hold of it. There is a certain amount of vibration on any locomotive going at any rate of speed.

In operating a locomotive in switching service with a hand lever, as a rule, I stand up and have my back out of the window, so that I can look in both directions and keep a lookout. Once in a while
526 I sit down. It depends on which direction I am working in.

The engines I am operating are equipped with drop seats. When I sit, on some of them I sit straddle the seat and work with my back over the arm rest where I can look backward and forward. Then there are some in which I sit in a three-fourths angle and can look out of the window when I am working ahead and get a direct view when working back where I can look through the back window or outside the cab. On our switch engines the tanks are cut down so that you can look over them, but they are a flat tank. That is what I had reference to by saying, "looking through the back window." I do not always look through the back window. As a rule I look from the outside, that is, outside the cab. I can look out through, right directly out, without looking through the window. I can look to the rear from the side cab window. Under those circumstances I have never had any difficulty in observing signals and keeping a lookout in general when operating the hand lever, neither have I had any such difficulty in operating engines equipped with power reverse gear equipment. In operating engines with power reverse gear in switching service, I take practically the same positions as I do with the hand reverse. With the engines which I have operated equipped with the power reverse gear, I have been able to stand up and operate the power reverse gear. There is one exception—we have a class Z engine on which we sit down most of the time. I have worked with the M, M–1, M–2, and Z types of switch engines. I find that I can operate a hand lever locomotive more economically than I can the air reverse lever, and in my experience the hand lever is the safest of the two (T. 1917–1936).

527 ERNEST C. RICHTER, on cross-examination, testified.

I am not a member of either engine service brotherhoods. I have been a member of no. 388, the firemen's organization, that was for a period of about 18 years.

I have never found it necessary to use two hands in handling the manual reverse lever during all my 10 years of experience. I have had passenger-train service. At high speeds I do not hook up the lever. I have got my lever hooked up before attaining high speed. The high speed that I attain when I hook up the lever, is probably 25 miles an hour, and I never hook it up after leaving that speed. When running at 25 miles an hour, it depends on the condition of the roadbed as to whether I hook it up with one hand, that is, uphill, down hill, or on the level. Taking an uphill condition, well, if I want to drop her and I am sure that it is all right, I grab hold of her and let her go, and set her down where I want to set her down, and that with one hand. I am talking about a speed of 25 miles an hour. I do not hook an engine up going uphill. In going down hill, I naturally get my engine hooked up where I want her and do not have to hook her up any more at that particular place, that is, I have got her hooked up as I am starting down hill. When on the level, I am hooking her up and with one hand. Only on one of those conditions do I handle the lever to hook her up, that is, when I am running on the level. On passenger-train service, when I get the engine hooked up pretty well, I have had them as high as 80 miles an hour, while on freight I have had them as high as 50 or 55. The highest rate of speed at which I customarily drop the lever down a few notches is probably 25 miles an hour. Thus I do not touch the lever after it reaches a speed of 25 miles an hour, either to hook it up or let it down. Under those conditions I have never, to my knowledge, touched the lever, either to hook it up or let it down. My position in handling a lever at 25 miles an hour
528 depends on the kind of engine I have and the kind of run I am on. If I am on a freight run and have an R or R–1, I have got the lever alongside of me. If I am on passenger, the 1500 type, that lever is in front, and all I have to do is to reach down or stand up and guide it. With respect to the R freight engine, I do not know whether I brace myself when I am going to hook up a lever or drop it down. That is something I could not say. I do that unconsciously; whether I brace myself either time I do not know. You have got to brace yourself to a certain extent, no matter what you do. In bracing myself, I go around her. I have my feet down in front of me. I do not have my feet braced and do not use a foot brace. In most cases, I use one hand. In some cases, I use two hands. I use two hands when I am standing up. I hook up or drop down an engine while standing up. In that case, my feet are underneath me. They are not against any foot brace or any part of the boiler. The position of my feet are that they are spread out. I have never had a lever pull away from me. With respect to the tendency of the lever to pull out of my hands, when hooking it up, or drop down the engine, at 25 miles an hour, there is a certain amount of pull on all levers. How much it is I do not know. As a rule, I have not hooked up an engine or dropped it down when the valves are dry. I have had a little of that experience. The reason

I have not had experience in hooking up when the valves are dry is that I do not very often have dry valves. If I do have dry valves, I do not see why I should handle the lever because the valves are dry. I have not handled the lever when the valves are dry. I do not remember any occasion when the valves were dry, when it was suitable to adjust the lever. The engine that I have run, the valves have very, very seldom got dry. With respect to the question "But when they have gotten dry, that has not occurred at any particular point where it was not necessary to adjust the lever?", I could not say whether it has or not. I do not have any recollection that the lever handled harder when the valves were dry than when they were
529 not dry. As to whether I have ever reversed an engine in yard service or anywhere else, when there has been steam in the cylinders; I have never seen in my cylinders. With respect to getting rid of steam in the cylinders, well, when we are switching up and down, by the time you make a stop, shut off your throttle and stop, your steam is exhausted, all gone, and you drift two, three or four cars, depending on how many cars you have. I have been asked to pull ahead. Just a little after I have stopped. Upon those occasions there was no steam in the cylinders, unless I did it. I have had couplings to make after pulling ahead, and I have missed a coupling. I have had to make two or three attempts to make one coupling, and, in making couplings, I probably have a little steam in the cylinders. I imagine there was a little steam in the cylinders, when I reversed the engine. There might be a little steam in the cylinders, when I have the couplings to make. I have never taken any notice of the difference in the amount of pull on those levers, when I throw them over, as to whether there is steam in the cylinders or not. It does not make any difference to me. In the yard I have always been able to throw them over with one hand. I have never needed to take two hands. I have taken two hands to throw them over, depending upon the position I was standing in, off balance. I don't know just exactly how to explain "off balance." I just was not sitting right to operate the lever at that particular moment. The position of my feet, when sitting on the seat-box and reversing the engine in yard service, depends upon what kind of engines I have. If I am backing up, I have got my feet right down on the deck, and have got the lever in front of me. It is probably 4 inches from my knee. I do not have my feet on the quadrant. I do not have any foot brace extending out from the quadrant. I have never seen a foot brace on a locomotive that I have ever operated. The reason I do not have my foot on the quadrant is because I have room to put my feet elsewhere, and I do not know of any other reason. I intentionally keep my feet off the quadrant at all times, the reason
530 being that it would be unhandy to put my feet there on the type of switch engines that we have. If I put my foot there, just exactly it would be putting it where I least need it, and that would put me in an awkward position, putting it there. The road

service engines are R–1's and R's, and the quadrant is on the side, and with our 1500 type class E engine the reverse lever is up front alongside the boiler. On the R engines used in road service, while sitting on the box, the reverse lever is probably within 8 inches of my leg. I guess the seat-box is about 23 inches, somewhere thereabout. I do not know just how wide they are. The lever is something like 31 inches inside the side wall of the cab. To my knowledge, I have never reversed an engine when the link motion was tight, or block binding in the link, or any other portion of the link motion. To my knowledge, I have never had an engine where the reach rod was binding on the brackets.

On the occasions when the power reverse gear creeps, all I have to do is to adjust the lever a few notches to bring her back. In some cases, the gear comes back of its own accord. I have never been injured by reason of the power reverse gear creeping. The lever inside the cab stays stationary, while the creeping is going on. I have never been injured in any way with power reverse gear. On the occasion when I had the emergency application of the brakes and broke the drawbar, there was no one injured. The conductor said he got a jar back there when the slack ran in, but that is all. I had given the lever about 3 notches. She was down to 3 notches from center, that was bringing it up just about on center. The air reverse, the air in the cylinder did not become operative until after I had given it the 3 notches. Just as I got there about center is when she took. She kicked me back, and kicked back in the backward motion about 5 or 6 notches, and by the time I could get her to go forward she had bunched the slack on the head end. It did not kick the lever out of my hands. I had it in my hands all
531 the time. The lever did not remain stationary. It came back when the reverse gear could move. The power reverse was a Ragonnet. That happened about two years ago this summer, and the engine number was 2479. I did not report that occurrence in writing. I reported it verbally to the night roundhouse foreman at Butler. I reported in the work report that the drawbar was pulled, and I did not know just what to report on the air reverse gear, and I went to Mr. Roos and explained just exactly what took place and told him I wished he would see what was the matter and repair the defects, and he said he would. When I say that the lever takes these extra notches about 4 or 5 times a month, I report it on those occasions. I do that in writing. The last occasion that that happened was sometime last summer. I have not reported any since for that cause. Where the power reverse is maintained properly, I have had no difficulty with the creeping. Outside the time the reverse gear froze, I have always been able to reverse the engine with the power reverse. On the occasion that it froze, I melted it until the water ran out of the air cylinder. It is hard to say how much water ran out, but quite a little stream came out of both cocks. It ran out in a little stream for 2 or 3 minutes and then it trickled. The

water came from the steam connection to the air reverse. I was not at that time operating the air reverse with steam. There was a leak in the steam connection (T. 1936–1952).

532 I discovered the valve on the "nigger head" was not shut off and the steam, I presume, leaked by the two-way cock and got into the air cylinder with the air. That is the only experience I have had with the power reverse freezing.

On the occasion in the Proviso yard when the engine jumped forward, when I first saw the engine I got my oil can and oiled around for about 10 minutes, then I let the lever down a few notches. I generally put the lever right down in the corner when I intend starting an engine in forward motion. On this occasion I let the lever down a few notches and it went all the way to the corner. The lever was right straight up and down—it was in the center. If I had a hand lever on the engine I would have thrown the hard lever in the corner and the engine probably would have jumped out like she did on this occasion. If the power reverse is properly maintained, I do not find it necessary to use two hands to operate it. I mean the air reverse. I have operated many of them using only one hand; it takes no particular amount of strength to do that. The cause of my using two hands under certain circumstances is, well, it is an extra precaution from experiences I have had where the engine would take two or three notches and then take two or three notches to go down farther, and I have that hand there to assist the other one keep the lever from going down and let it pull down in forward motion, or whatever it may be. I do not know whether it is in the reverse gear and lever or the cylinder that takes the extra notches. It is not necessary to hold on to the lever with both hands to keep it from moving, but I do that as an extra precaution. I have never been injured in handling the power reverse gear in the cab, but I have had jolts. By "jolts" I mean you have the lever part of the way down toward the forward motion, or the backward motion—of course, you would have to

533 have it in the forward motion to get the jolt—and when you go to hook it up—I mean with this one particular engine, I hooked it up three notches and she did not take and she gave me a shot in the arm before I could stop it. I have had that happen on other engines. I do not know the cause, unless it is some part of the air apparatus not working properly. I know that the only thing the hand lever in the cab does on an air reverse is to move a rotary valve. The reason a rotary valve kicks back may be because the valve is not responding to the lever—probably is not unseating itself. As to whether there is the same kind of valve in the air brake, I do not know how they are constructed. I do not know anything about the air reverse, only the experience I have had in operating them. I have a rotary valve with air brakes, but do not have the same experience with that kicking back. My experience is about 50–50 with hand and power engines. The power reverse has gradually increased. At the present time I should imagine about 70 or 75 percent of the engines on my division are equipped with power reverse. In fact, all

our big power is equipped with power reverse. I believe that 75 or 80 percent are power reverses in all classes of service, yard service, road service, etc. That is, on my own particular division.

I could not just exactly say when I first began to notice the economy of a hand lever over a power lever. With respect to the economy feature of the hand lever, well, I would have to refer to a smaller type engine, with the big type engine. The way I determine the economy of the power reverse and the air reverse on our J-type engines was when I would get an engine where the air reverse happens to be working in first-class shape, and then I get an engine on the same run, or the same engine and she creeps, and then I burn more coal and she uses more water.

534 In response to the question, "I know, but suppose you have a power reverse which is working properly and you have a hand reverse that is working properly, would you say that the hand lever engine is more economical than the power?" the witness stated, "I cannot put a hand lever on a J engine, where I have only got air reverse gear." My opinion that the hand lever is more economical than the power lever is based upon the fact that our Z engine, when they first came they all had hand reverse levers, and up until a few years ago when all were equipped with air reverse, and I have ascertained the difference in that type engine as to the difference in economy between the two. That is based upon the amount of coal I burned on the engines I ran on those runs. I could tell when I got in, how much coal I would have burned. Those engines were equipped with power reverse in the last 10 years, probably, that is throughout the last 10 years. On some engines when I first got power reverse on those engines I noticed that they burned more coal and used more steam. I have no way of measuring the coal only from observation in the coal rack when I got in. Some tanks hold 15 tons, some 16, some 12, and some 13. Taking a 16-ton tank, I could not observe this difference at all times, because every engine would not creep. On those that did not creep and had the power reverse in good shape, there would be a difference in coal consumption as high as two or three tons on a trip. With respect to this particular J type, I could not tell whether there is any difference, because we never had a manual on them; but I can tell the difference between an engine that has a reverse gear working properly and one that is not, and that is where this difference in the amount of coal used comes in. I have had a power reverse gear that did not creep. My comparison is between two engines equipped with power reverse, one creeping and one not creeping, and not between the power reverse and the

535 hand reverse. In answer to the question: "Now, do you go farther and reason that the hand gear is the same as a gear that won't creep? Is that the way you get at the comparison between the power gear and the hand gear?" witness answered: "The way that I compare those things is that in a passenger run we have passenger engines of the same type, equipped with air, and some of them that are hand power, and that is the way I have ascertained

the difference." In passenger runs we have some engines of the same type equipped with hand levers and power reverse. Taking one of those with power reverse which does not creep and comparing with the economy of one of the hand lever engines, well, I ascertain the difference because I had an engine that did creep and one engine which had the power reverse gear on this particular run, and I noticed a difference of about two tons of coal. I arrive at the conclusion that the power reverse is less economical than the hand reverse because this engine at that time was creeping. These comparisons are between the hand gear and the power gear that was creeping. I do not believe I have ever made a comparison between a hand gear and a power gear that was not creeping.

I have never been hurt in any way with the hand lever, nor have I seen anybody hurt. I have never been hurt with the power reverse, nor do I recollect that I have ever seen anybody hurt. The reason I say that the manual reverse is safer than the power reverse is, well, when you operate the hand reverse gear you get direct control of all movements, and when you put a lever in one certain position it stays there; and with the power reverse gear I feel you do not ever know where it is. As to the question, "What difference does it make if nothing has ever happened?" the witness stated that, "Supposing a man was working around an engine, working around a power reverse engine, and a man comes around and starts the pump, and the man working with the power reverse, if the gear happens to creep
536 and is not in a proper position and moves, this man is apt to get hurt. No one ever told me about that, and I have never seen it, but engines have performed that way, although I have never seen it. Other fellows have seen them perform that way. There are two different men I have spoken to who have seen them. I could not just say who they were. I have spoken to several fellows who have seen them move, but I have not." In answer to the question, "Whether your opinion as to safety is based on what you know yourself, or what others have told you", witness stated, "Well, from the experience I have had from engines creeping when running, you cannot depend upon that gear at no time, and with the hand reverse lever, why, it stays where you put it." The manual reverse lever is connected directly with the valve motion through a lot of other parts—from your reverse lever to the reach rod and the valve parts. There is some weight on the manual lever by virtue of this mechanism. There is a lot of weight hanging there, but it is taken care of by counterbalance springs, and my experience is that these counterbalance springs always counterbalance the weight. I have never noted a counterbalance spring that was the least bit out of tension. In working the manual lever, it does not take the same pull through the movement from full forward motion to full backward motion. It changes after it leaves the center. After leaving the center, coming back, the counterbalance spring acts. The way it acts is the double counterbalance spring—one acts when you are pulling one

way and the other acts when she is going to make a complete stroke beyond. When you go beyond center, going toward back motion, you have to push on it. In putting your manual lever into full forward motion, it is necessary to push on it and I think that push overcomes the resistance of the counterbalance spring. As to
537 whether, if the counterbalance spring broke, there would be any weight on the lever tending to pull it forward, well, I never had it happen to me and I could not say. I do not know if the counterbalance spring broke if it would tend to pull the lever forward. In running, this manual bar rattles. I do not mean just the bar, but I mean the latch and part of the dog—what I call the dog is the part with the teeth—it sits down into the quadrant. It does not have much play to rattle sidewise. It has to rattle in the direction of the quadrant, because one is placed around the reverse lever and the other in the back end of it. I suppose it is the vibration of the engine that makes it rattle forward and backward in the quadrant. There is a pull on the lever on account of the valve motion itself, coming through the links, through the reach rod, and up to this bar. I do not know whether the stroke of the valve affects the manual lever and puts a strain backward and forward. If I am running forward and am hooked up fairly well, and want to let the manual lever down a notch or two, I get the feel of my engine; I do not release it until I know whether it is safe to release it or not. I do not mean "safe" but I get hold of it and let it down at the proper time. There would not be a wrong time to do it. What I mean by "proper time" is to be in such a position that I can let it down, that is, as to where or how I am placed to do it. If I am seated, or approaching it in the right position, I could release it at any time. To release it I just get right up and release it with my left hand. I reach down with my left hand and let out the number of notches I want. The dog is a latch setting in on the back of the reverse gear. I just grab the latch and hold the front end of the lever with my forefingers [indicating]. You have to grab the latch to release the dog in the quadrant. A spring holds the dog in the quadrant. I have never had a defective spring, nor one which was weak. I do not remember ever having a spring making it
538 too stiff. They have all been in perfect condition so far as I am concerned. Having gotten the dog released and in that position, the bar does not remain stationary as you hold the dog. She has a tendency to go toward the forward motion, if I was going ahead. It would pull it out of my hand if I let go of it. There is no way of finding out how much power I would use in holding on to it. It would go down in forward motion if I let the latch get released. If I were going 25 miles an hour and let go of the latch, she would go to the corner, and I suppose she would go quickly. The pull on it comes from the valve gear. If there was any defect in the valve gear such as the valves becoming dry, that would have an effect on the amount of pull. I do not know whether, if the valves

became very dry, there would be a strong pull on the lever, as I never had a valve very dry. I have used engines with slide valves but I do not remember that they have ever been dry. I believe I have worked water on a locomotive, the effect of which is to wash off the lubrication to a certain extent. The amount it washes off depends on how much she works water. I believe I have had locomotives work water to the extent that it would affect the valve motion. I would notice her working water by the exhaust. I have had that happen with a power reverse. Maybe two or three times I have had dry valves with a manual bar. I knew it was getting dry by the extra noise of the reverse lever. The cause of this extra noise was, I suppose, the little added pull would make the valve a little harder to operate. What I mean is the valve functioning in its chamber. It was not the noise of that valve I would hear, but the noise of the reverse lever. I don't know whether it was a tremendous pull on that lever because I did not touch it. I did not deliberately avoid touching it. I did not have any occasion to change it. When
539 it began to get dry, I eased off on the throttle and increased the lubrication, as I had an inside lubricator. I have never taken any particular notice how badly the notches were worn in the quadrant or whether they were worn at all. I would say that so far as I am concerned the notches have not been worn enough to attract my attention. The dogs are loose in the notches in the quadrant because you could not get them out if they were absolutely tight. They are pretty close. I do not remember of any occasion where they did not fit pretty close. I do not know of any occasion where the quadrant has not been adjusted properly. I have never had any occasion in my experience of there being anything wrong, of any kind, with the manual reverse bar.

The hand reverse is more economical than the power reverse. That is, the power reverse is wasteful of coal and fuel as compared with the manual reverse, if the power reverse gear creeps. I do not know about this if the power reverse is in proper condition because I have never tried. I have never reported the wastefulness of the power reverse to my company. I have never reported the danger of the power reverse to my company. I have never had any official position with my company.

My usual position in switching is with my back to the window so that I can look out both ways. We have one type of engine that we cannot sit down with. That is, we did have one type of engine that we could not sit down with with the hand reverse, but they have put power reverse on now. With those engines that I stood up with, equipped with the manual reverse, it all depends on which way I was working as to which hand I used to operate the reverse lever. I most generally used my left hand. If I were in the position above described, standing with my back to the side window and taking a signal from the rear, if my manual bar was in
540 full forward motion and I wished to throw it into backward motion, I could reach it without bringing my head into the

cab. Under those circumstances, if it was in the forward position, I would reach it with my right hand. When in switching service and taking signals from the rear, I would not at all times keep my head out of the window. I would take it in to look and see how much water my fireman was carrying or to see how much steam I had. The way our engines are equipped, standing up, with manual power, I would not have to bring my head in in order to get hold of the manual lever and throw it to the desired position. If I were in that position taking signals from the rear and the manual bar was in full backward motion and I wanted to reverse it, on most engines I could reach it with my left hand, but I would have to take my head in. I could reach that with my right hand, in full backward motion. In that position I could move the reverse lever. When I am reversing an engine I do not have steam in the cylinders. On an "R–1" engine I would say the reverse lever was about 31 inches from the side of the cab. On this particular engine I have been speaking of, I would say probably 24 inches, maybe not that much. The bar extends between three and four feet above the deck. I would say that would make the top of the lever probably three feet above the top of the quadrant, the highest point (T. 1952–1979).

ERNEST C. RICHTER on redirect examination testified:

In passenger service I operate, or have operated, the same class of engine, one equipped with power reverse gear, and the other with hand gear. That was the "E" type, or the Pacific type. There was a difference between the coal consumption on the hand operated engine as compared with the coal consumption on the power reverse gear engine, which I spoke of. Having been on this one par-
541 ticular run, two trips in succession, and the regular engine I had the first trip, with the hand reverse, and I had the same amount of cars and the same amount of stops both days, and when I got to Milwaukee I had two racks of coal left on the engine with the hand lever. The next run with the power reverse gear the fireman was pulling coal before I got to St. Francis. St. Francis is 4.5 miles from Milwaukee. On the hand lever engine the fireman did not pull coal at all; we had two racks of coal left when we got there. By two racks of coal I mean our coal is put in there and they have four boards. They sit in on a slant. The coal was up to the second board. The four boards run up to about four feet high. We do not ever remove the boards until we have to pull coal. On those trips I would judge the difference in coal consumption was about two tons, that is, on the run between Chicago and Milwaukee. On the two different days I was going in the same direction, a distance of 85 miles each way. I had the same fireman on both trips. Both engines were hand fired. The weather was just about the same. I do not remember just which way the wind was. It was in freight service that I had a similar trip over the same territory with the same class of engine with a power reverse gear which was not creeping. In answer *the* the question, "What is the fact as to whether on

this trip which you are comparing, the power reverse gear was creeping?" the witness replied that he could tell every time the engine would go over a little knob, she started to get her speed, and when she hit a knob she would creep down and exhaust and get stronger, and after I got over the knob, I could feel her coming back and getting to the position where I had her hooked up. The trip on which I am comparing the coal consumption of the E engine with the coal consumption of the E engine equipped with the power reverse gear is a case where the power reverse gear was creeping (T. 1979–1982).

542 CHARLES S. THORP, whose occupation is fireman and running a locomotive for the Chicago & North Western Railway Company, residence Chicago, age 69 years, testified:

I started firing in 1880 and was promoted to running an engine in 1883 and have been running an engine continuously since that time for the Chicago & North Western Railway Company.

I weigh about 170 pounds. I have run engines equipped with the hand-lever type of reverse gear ever since I have been employed by the company up to the present time and am still handling them. In the beginning of my service I ran different types of engines, maybe 6, 7, or more years, without any brake of any kind, the engines not being equipped with them at that time.

In the past few years I have operated power reverse, but not very much. That was in the last five or six years and not over three to five hours in a day. That was due to the fact that I would get relay engines. My work is nine hours a day. I do not have the same locomotive throughout the entire nine hours. I handle from 10 to 12 different individual engines on my present assignment, which I have had for the last nine years. My assignment is termed a relay job in the Chicago terminal. It is in switching service. When I had the hand-lever engines without brakes I just used the hand lever for braking power. The way we did that was when we needed to make a coupling we would shut off in ample time, let her drift a little ways, and when she was coming up reverse her, and if we were going to stop short we would throw her back until she was in such position that we could couple on without any trouble. Sometimes we would have to reverse two or three times in making one coupling. In those days we had a pin coupling. I was able to control the starting and stopping of my engine in that way. That is, with the hand lever at all times. I never had accidents with it.

543 During my entire period of service I had one experience with the hand lever becoming unlatched and going to the corner and as near as I can remember that was four years ago. I had her hooked up about half way and she simply went down in the corner. The cause for that was after I got the engine out of the house and started, somebody had been careless in filling the lubricator and allowed a little oil to accumulate and get on the quadrant. That only happened once, and when I found the cause

of it, I immediately washed it off good and wiped it off with waste, and it did not occur after that. I do not recall any other occasions when I had the experience of the lever coming unlatched and going to the corner. I do not remember a hand lever pulling or getting away from me after I had unlatched it. Of course she has dropped in the corner. By dropping down in the cornerI mean as far as she could go on the quadrant. The time I heretofore referred to I did not intend her to go down in the corner but it happened that time on account of the grease being in the quadrant. Other than that, I have not had the lever go into the corner at any time I did not want it to go there. I have handled hand levers for 50 years commencing right after I went to firing, and was about to handle them and relieve the engineer all through my running, and I was never injured with it, and I do not recall anybody who was ever injured by it. Not only that but three members of my family have served the company 150 years and no one of them was injured in that combined service. With respect to the clearances in the vicinity of the engineer's seat box on the locomotives which I have operated on the North Western Railway, well some engines which we are operating are all equipped with the drop seat on the side of the cab. You can either raise it or lower it or stand up or sit down, either one, according to the nature of your work or how you feel about it. If I
544 was sitting in this position on the seat I would judge there would be about four inches (indicating). In this position I would be sitting square facing ahead or in the reverse movement, facing back. Sometimes I sit on the seat facing directly back with my feet in front of me. Sometimes I straddle the seat with the window out this way (indicating). In that position I have my back to the side of the cab window. Using these various sitting positions I have found I could always get myself in a good position without exerting myself any to see signals given by men on the ground or on the train and to keep a look out in general. I could do this either standing or sitting. When standing my position would depend, of course, on the direction in which I was going. If going this way I would stand this way or if going this way I would stand that way (indicating). On the hand lever engines I am able to stand up and operate the lever standing still.

On engines which I have operated equipped with power reverse gear well, except the M–2 class on the North Western road, you have to sit down all the time in order to operate them. The M–2 class, you can stand up, the way they are equipped. In sitting down to operate those engines we sit facing forward and it puts me in kind of an awkward position to see signals and do my work, especiall backing up. There is not room enough between the back of the cab and throttle. If you turn this way and in backing up sit in the opposite direction then you will strain yourself (indicating). There has bee nno effect upon me physically, as a result of operating engines equipped with the two types, the hand lever on the one hand, and the power reverse on the other. I am not any more tired by one

than the other. Sometimes the work is about 50–50 during the day, but I think if I would handle engines on the North Western road in the switching service, the M–A and the M–3 type, that I would be a little more tired in handling the power reverse in the
545 position that I would have to sit in all day in order to handle them. I would have to sit in that position all the time, handling that engine and it would give me an awful twist in the shoulder and neck. That same thing would not be true with the hand lever, because I can turn and put myself in different positions, standing and facing either way, or sit down, either one. My position of engineer seniority in the Chicago terminal division is no. 1. There are jobs there which I could select where I would have engines equipped entirely with power reverse gear. I believe we have about 130 jobs in the terminal, and, according to my seniority rights, I could take any job there. In our territory we have a couple of men of approximately my age whose position on the seniority list would entitle them to hold exclusively power reverse jobs and they have got off power reverse and gone on hand reverse. Once I observed an engine moving out of the roundhouse without any one on it, circumstances being, I was going across from the turn-table into the roundhouse in order to get an engine to take out. On my way across the turn-table and through the circle, I seen an engine backing out of the roundhouse. I knew that engine was not to go out at that time, and I knew that that engine had been laying in the shop. When she got out right near the door I could see there was nobody up in it. I jumped up into the cab and tried to stop the engine, but I had no means of stopping her. Then I jumped down again and the first thing I came to was a piece of 2 by 4 and I threw it into the driving wheel in order to stop her, but she was just going fast enogh so that she clumb over it and went into the turn-table pit and the hind trucks went down into the pit. That engine was equipped with a power reverse. I tried to operate the power reverse and it did not operate. The air pump had not been started, and there was no way to operate it. There was no other engine attached to it
546 at that time. It had been pulled or pushed by other engines a couple of times while in the roundhouse undergoing repairs. They had just got through and had fired up in order to take her out and put her in service again, but the engine had not been ordered out up to the time she went out. There was no other engine on the track between the roundhouse wall and the turn-table pit. The cause for her walking off like that was that the engine had been fired up, had been ordered fired up and they fired her up all right, and I do not know. The throttle had been left partially opened. When she had steam to move herself she naturally walked right out. She was not going very fast. She did not have pressure enough to run her any faster. If that engine had been equipped with a hand lever, I would have been able to reverse the engine, open throttle, give her the steam in order to start her in the opposite direction. It would

not be necessary to have the air pumped up on a hand lever. From my past experience with the use of hand levers for braking purposes I think that there was sufficient distance on this occasion in which to have stopped the engine and have avoided the hind trucks going into the turn-table hole and prevented the small amount of damage done and also the delays which were caused by it. Other engines were delayed by getting off their regular schedules. It tied up a certain number of engines in the roundhouse on account of not being able to turn the turn-table in that direction. On that engine there was an auxiliary steam pipe connection to the power reverse gear. The type of power reverse gear was an "Alco." I did not make any attempt to use the auxiliary steam pipe connection because I would have to open the front door of the cab to get out on the running board and open up the steam valve on the nigger head. I think the hand lever is safer than the power reverse (T. 1982 to 1998).

547 CHARLES S. THORP on cross-examination testified: I will be eligible for a pension next year. I will be 70 years old if I live. Over 50 percent of the engines which I am getting in this relay service are equipped with power reverse. The power reverse are on the heavier type of engine. The lightest weight engine in that service equipped with power reverse is 163,000 pounds. My company has been equipping more and more of them with power reverse as the years have gone on and those which come over in our territory I find have been equipped with power reverse. There are yard assignments where only the manual reverse engines are used. I have not taken one of those runs but I did have previous to taking the job I have now. That was about 9 years ago. I could still take one of those jobs if I wanted to and I have got one already picked out, and if they change this one I will take it. I do that on account of the hours and being accustomed to the engines I have handled them all my life. I have found in my experience in handling a manually reversed engine has been, that with any difficulty in the steam chest the lever works harder. With dry valves or if the engine is working water there is little more pull on the lever sometimes, but nothing out of the ordinary. While running along I have observed the lever vibrating in the quadrant. It does not move back and forth. The rattle is sideways; play in the quadrant. The largest locomotive I have run in road service is the R–1. I do not know the weight. It is quite a while since I have run one of them, I do not recall the number of years. I handled them in transfer service quite a long while. They would be the largest I have run in the Chicago terminal service. Other engines in this territory run to 174,000 pounds, they are the M–3 type. I have run those every day, about 50–50 with the hand lever, on the work I am doing today. I have been

548 operating that type of engine as long as they have been in our territory and I guess it is about 6 or 7 years. The M–3's type which I have been operating are all equipped with power reverse. I nevr saw an M–3 equipped with hand reverse—I do not think we ever had one that was equipped with a hand reverse.

No one was injured the time the engine moved out of the roundhouse and into the turn-table pit. That is the only case I know of where one of the engines ran away by itself. That engine weighed 163,000 pounds. I never reversed one of that size with a hand lever. A large engine is no harder to reverse manually than a small one. I have handled small engines with hand levers which would handle as hard as large engines. The large ones I speak of range from 140,000 to 175,000 pounds. I have never reversed 175,000-pound engines with a hand lever. I say that a heavy engine is no harder to reverse with a hand lever than a small one because we have had other types of engines that would not handle as hard as a small one. I know that with engines weighing from 80,000 to 130,000 pounds, that some of those engines with hand levers would handle just as hard as—that is, 80,000-pound engines would handle just as hard as one weighing 120,000 pounds. That is what I formed my opinion on. Tney would not be very hard to work. I have handled them, as I say, all my life, and I do not think I have been abused from handling them from the looks of me and from the condition I am in. There have been times when I used both hands in handling them, also engines I have handled I have sat there and pulled the power reverse with two hands. I do not know whether it is absolutely necessary. An engine comes out of the shop, and probably for a day or two you would have a harder pull and you would use two hands in doing that, in preference to one, the same as you would
549 if you went to back up, you could back it up with one hand but lots of times you would take two and back it up, or I would (T. 1998 to 2005).

CHARLES S. THORP on redirect examination testified: I have never operated a class Z (what is called the "Zula") any more than to transfer them from the track shops over to our territory and back again. I have handled them equipped with a hand lever. I do not know the weight on drivers of those engines (for the record it was stated that they weighed 209,500 pounds), the lightest of them running from that up to 214,500 pounds. From my experience in handling the reverse lever on its Z type engines I did not find any greater difficulty in handling the reverse bar than on the other types of hand lever engines which I have operated. Of course, as I have said, I have not handled them very much, only in that respect, and I did not find any difficulty in handling them. As to whether these Z engines are harder to reverse with a hand lever than 80,000-pound engines, I have never run them enough to take particular pains to notice it. I would only reverse an engine a few times going over and coming back to the shops, a distance of about 5 miles.

CHARLES S. THORP on recross-examination testified: I have found that with respect to engines on our road that an engine weighing 80,000 pounds on the drivers is as hard to reverse as one weighing 120,000 to 140,000 pounds (T. 2005 to 2007).

H. HERRICK, locomotive engineer, employed by the Chicago & North Western Railway Company, residing in Chicago, testified as

follows: I went to work for the Chicago & North Western Railway Company as a locomotive fireman in 1901; was promoted to run an engine in 1906. I ran off and on from 1906 to 1914. From
1914 I have been running steady. When I was on the extra
550 board I had mostly all classes of service; not much switch
engine service, because there is a terminal there and we haven't any rights in the terminal. I am now in freight service running between Chicago and Janesville. That is, time freight service. In recent years I have had experience in freight service between Chicago and Milwaukee; Chicago and Butler; Chicago and Fond du Lac. Those points other than Chicago are all in Wisconsin and that comprises the territory in which I have put in all my service. I have operated all classes and types of locomotives that the North Western has except the L's, the H's, and the J–4's. While I was on the extra board I had experience in through passenger service with respect to my experience on engines equipped with hand reverse and those equipped with power reverse. Well, we had the class Z engines come here with hand reverse on them, and the power below that, the R's and R–1's were always hand reversed and still are today, but the class E engines came here as hand reverse and the class J engines came here with power reverse. I operated hand reverse quite frequently until they equipped the class Z engines with power reverse. That must have been 10 years ago or 8 years ago or something like that. During the past ten years very nearly all of my time has been on engines equipped with power reverse. Once in a great while—I don't recall any, but I may have gotten an engine with a hand reverse, a small engine, but I don't recall it. Prior to the last 10 years nearly all my time was put in on the power reverse. As I said before, I had the Z engines when they came here with hand reverse and up to the time the power reverse was put on them. I handled the J's with power reverse when they came. The J's came after the Z's. The Z's came here but they came with hand reverse. Up to the time I
handled the J's with the power reverse and the time power
551 reverse was put on the class Z's, all my experience was with
hand reverse. I have never had a hand lever become unlatched in the quadrant, nor have I been injured in any way by a hand lever or in connection with this operation. I have never had a hand lever pull away from me after I had unlatched it in the quadrant. I don't know what type of gear was put on the class Z engines when they were equipped with power reverse gear. I know it wasn't the Barco. Some of them were equipped with Alco and Ragonett. I can't tell just which ones were equipped with the different kinds. During the past ten years my experience with power reverse has been with the Barco type of gear. I have not used it exclusively. I have had others now and then when I would lose my own engine. I might get one equipped with the others then. As to my experience in the operation of these power reverse gears, as to whether or not you could maintain a fixed point of cut-off, well, I have had them where they would and I have had them where they crept. They would

keep shifting the point of cut-off back and forth all the time. My experience during the past ten years has been that sometimes they go along pretty nicely for a while and not creep and then they would start creeping and creep frequently for quite a while, until I would find out the cause of it and fix it. After they started creeping I never found one that would stop creeping permanently without doing some work on it. After having work done on the gears, my experience has been that some of them would work along quite a while, maybe two or three months and some of them maybe two or three weeks. I couldn't state any definite time. With respect to power reverse gear engines going into reverse motion I had engine 2558 and I was pulling out of Sharon side track one morning after letting a passenger train by, and not going over 10 miles an hour in order that I could slow down for them to close a switch, and I reached down to pull her up and I pulled her up with one hand. I wasn't paying much attention; I figured on pulling her up about half way. I was looking out the window, and the first thing I
552 knew she let a kick out of her, as if she went into the back motion. I looked and she was in back motion. I went to throw her ahead again and couldn't move her into forward motion. I pulled her back a little more and tried it but I couldn't, so I had to stop. I got down to see what was the matter. I couldn't find anything wrong but I couldn't move the operating lever at all toward the forward motion. I could pull it toward back motion but couldn't get her in the forward motion, so I had to take the air out of her and take the cap off the worm gear and use the monkey wrench to move her to forward motion (T. 2007 to 2015).

553 That engine was equipped with a Barco type. The incident happened seven or eight years ago, at least. After I removed the cap I reversed it to the forward motion and continued on with the trip. I did not touch the reverse gear after that. I just went right on to Janesville without touching it. I was not able to determine the cause of gear acting as it did. Engine no. 2558 was a class J and was the regular engine I spoke of.

On another occasion with that same engine, in 1928, it went into back motion on me, the valve motion; she reversed herself and went into the back motion. I was moving between 45 and 50 miles an hour, as near as I can judge, with a freight train of between 40 and 50 cars, and was about 2.5 miles from South Janesville. Prior to the time of going into back motion, I had had no trouble with it. I did not attempt to unlatch the lever prior to its going into back motion or to touch it in any way. Nothing occurred to call my attention to any peculiar action of the engine just before the lever jumped into back motion. The lever did not move at all. It was the reversing gear. The lever stayed right where she was set. I tried to stop as quickly as I could by using the brake. I applied the automatic air brake and held the engine brake off and opened my cylinder cocks. That is all I did. That is all I could do. I did not touch the operating lever of the reverse gear until after I got

stopped. I don't know what effect this accident had with respect to the back end. With respect to the front end, when she reversed herself and went into the back motion and started to work against herself, I got an awful bang from the train hitting me and shoving me along. I applied the air brake and then she began to steady herself. The engine wheels were skidding. She stopped when she came to the stop. When I say the wheels were skidding, I mean they were locked and not revolving. I assume I skidded in the neighborhood of 50 or 60 car-lengths. I had flat wheels eight inches
554 long and a quarter of an inch deep. As to the tires on the driving wheels, they were changed. After I got the train stopped, I got down and the first thing I did was to take hold of the operating lever to see if I could move it, and I could throw it either way, but I had no control of the reverse gear at all. I got on the left side and walked around to see how she looked on the left side and to see if it was all together. I could not find anything wrong, and I walked around to the other side and could not find anything wrong with the valve motion and gave it up as a bad job. As I came by the reverse lever I saw the rod that comes from the operating lever to the valve down in the reversing cylinder disconnected. It was disconnected right where it couples on to the arm that operates the valve. (Reference is made to an exhibit and the witness pointed out the location of the bolt that had become lost and caused the disconnection.)

After I discovered the bolt was gone I went into the cab and I had a piece of iron pretty near as big around as your finger and I got the fireman to work the lever and I went down and connected it up and threw it into forward motion and pulled out and went to Janesville. I had no more trouble with it going to Janesville. With the speed I had to go with the flat tires and everything, maybe we were delayed from 20 to 25 minutes. I had to go pretty slow with flat spots. This engine, no. 2558, came here as a new engine from a locomotive works and went on that run. It has never been taken off, only to use her a trip now and then to some other place. It came here over 10 years ago, and it is a regular engine on that job. I don't have that engine when I am on some other job.

About 12 years ago I had experience with respect to a power reverse gear taking away all of my main drum pressure. That was just after the class Z engines were equipped with the air re-
555 verse. It was engine No. 2362 of the class Z type. It occurred with me three or four different times before I discovered what the defects were. I was on an extra run from 40th Street station in Chicago to Kenosha. On that trip I had just gotten outside of Mayfair and after I got around and straightened down I began to lose my main drum pressure. I first thought it might be the pump that stopped on me, or lagged a little bit. I thought she would come back, but she leaked down right to the train line pressure and continued to leak until it applied the brake on the train and stopped me. I got down, as did the fireman, to see if we could find

any leaks around any of the main drum appliances. I got back up on the engine and she started to pump up the pressure. We got the required pressure and continued on our way and went about 10 or 12 miles to the first water tank and she was lagging on me again. I stopped there to take water and looked around to see if I could find any leaks, but I could not find any. I started out from there, and from there there is quite a little grade. I got up on the hill and she leaked back far enough again to stall me. It was getting dark by this time, and I had my torch with me and got down, and went all over the piping again with the torch to see if I could find any leaks. But I could not find any. Going back along the right side of the engine I happened to stick my torch into the ash pan to see how much ashes were in there. I did not do it to find any leaks, but just wanted to see how many ashes were in the pan, and I happened to put it in the exhaust pipe of this reversing gear, and she blew the light out. I went up then and cut out the air and turned on the steam, and continued on my way without any more trouble. This leak was in the exhaust pipe from the air reverse. I don't know where it did come from, I couldn't tell that. By cutting off the air I did not eliminate the leak, because the steam blew out there just the same, but did eliminate the leakage
556 from my air drums. When I got in from that trip I reported it on the proper form and also told the roundhouse foreman what I had found. I do not know what was done. I do not know if I ever got that engine any more. Outside of the creeping, there is nothing more I can tell with respect to the erratic operation of these gears than I have already told you. In creeping, sometimes the valve gear would move more than at others. I could observe it by the exhaust of the engine. I have leaned out of the window and observed the movement of the cross head. On the occasions that I observed it, I judge, when the reversing gear is working properly it will move between a half inch and one inch. That is a tumbling shaft. It did not move so awfully fast. Rapidity of the movement depended upon the speed of the locomotive, and the amount of throttle you were working. That is, when the reverse gear is working properly. By that I mean when you can not notice it on the exhaust. On the occasions when I could notice this creeping, I have observed that the cross head moves a great deal more than it did. It might be one and one-half inches, or between one inch and one and one-half inches, and sometimes more than that. When it worked properly it moved between a half inch and an inch.

As to whether I use one or two hands depends upon the kind of work I am doing. If I am sitting there, switching that way, I am using only one. I use two at night or when my attention is called to something else. I use one hand down here along the latch to see how many notches I am pulling it up at a time, when I am not looking at the lever. That is because you have a little power and you might pull it up a little bit and think you have only one but you

have three or four. In hooking up in the daytime, I do the same thing, because you get in the habit of doing things and it
557 becomes a custom. It takes more strength to handle the hand lever than it does the power reverse lever, but I do not know how much. I have at times pulled just as hard on a power reverse as I have ever pulled on a hand reverse. There is nothing about the quick movement of the power reverse gear that requires more strength. You can only move the power reverse so fast, that is, the ones we have. The ones we have will only come so fast, and it does not make any difference how hard you pull on them. As to my experience with respect to the economy of operation of the locomotive with the two types of gear, the hand and the power, well, if you have a power reverse that is working all right, I don't see that there is any difference in it. But if the power reverse is creeping, then there is no comparison. If the power reverse is creeping, it is not anywhere near as economical as the hand reverse. With respect to the standpoint of safety between the two types of gear, well, my own experience has been that I have never had an accident with the hand reverse, and I have had with the power reverse. My conclusion, from the standpoint of safety, is that if you are handling two kinds of apparatus, the one that you have not had an accident with you will consider safer than the one with which you did have an accident (T. 2015–2030).

H. HERRICK, on cross-examination, testified:

With respect to the accident just referred to, I was not hurt, but I did damage to the train. The lever stayed in the same position in the cab. If I had had a manually operated reverse and a driving journal, or any part came up and hit the reach rod and knocked the reach rod loose from its bearing, I don't know what would have happened to that locomotive. I don't know if knocking the reach rod out of its alignment would pull the latch out of the lever. If there was enough force on the reach rod to strip the teeth in the latch, I don't know whether the lever would jump out of the quadrant.
558 I am only going by practical experience.

I have observed the manually-operated lever vibrate in the quadrant, and I have seen play in the latch. I have seen play in the latch until it works back and forth in the notches, but not with play enough to latch it and unlatch it without its catching. I have never seen the latch chatter. I have seen the reverse lever, where it goes through the block, rattle on the side of the latch. I have never seen the dog working out of the latch little by little. The dog always stays put in the notches. I have never had any notches in the quadrant that were rounded off near the top. I have never had the dog in such shape that the teeth in it were worn thinner than they should be. My opinion that the manually operated lever is the safer is based upon my one experience, which has been heretofore referred to. To the question, "If the lever gets out of the quadrant and goes

down into the corner with a manually operated reverse, do you think that is a safer device than a power reverse?" the witness replied, "I will not answer because I have not had any experience on it." The question was in reference to cases where it jumps out while running along, and the witness replied, "I don't know."

I was not hurt on this occasion when engine no. 2558 at Sharon had the reverse mechanism go to the back motion, neither was anyone else hurt. And I never determined what was the cause of that accident. On the occasion of the accident outside of South Janesville I was not hurt. No one else was hurt that I know of. If, on that occasion, I had had a manually operated reverse lever and the bracket that holds the reach rod got broken or failed, and the reach rod had come out of alignment, I don't know what would have happened. I can't say that nothing would have happened. To the question, "It is possible the weight of the valve motion might have
559 pulled the lever out of the quadrant, is it not?" the witness refused to commit himself. Witness refused to express any opinion on matters with which he had not had actual experience.

The accidents referred to are the only times I have had any experience with the engine going into the back motion outside of when you would have her hooked up at a particular point of cut-off and she would creep back and you were losing the exhaust and then she would creep back again, but the reverse lever would not move a bit. When she is creeping I can ascertain it by listening to the exhaust. You cannot always recover the proper cut-off by adjusting the lever a trifle. You cannot do it at high speeds. She is liable to keep right on creeping just the same, even if you dropped it down a little. I have not always been able to overcome creeping, and when I am not able to overcome it I just let her go. That is all you can do—let her creep. On those occasions I report it and they fix it; they work on it and try to fix it. The first time or two they did not succeed in fixing it. That happened just recently on no. 2557, about the first of April, and I reported it on the proper work reports at Proviso and Janesville. I got the engine on the next trip. They had worked on it but they did not find the defects, and I reported it the next trip. I know they worked on it because they told me so. I called them up and asked them, and they said they had worked on it and it would be all right. I did not see them work on it. I reported it on the second trip and so on until it was fixed. I think I reported it for a couple of round trips on each end of the road, that is four times. That is the last trouble I had with that engine. She went on the opposite job from me, where she belonged. I never had any other engine except this Z engine, no. 2362, that lost the
560 air pressure, and I could not tell you where the leak was on that engine. Personally, after reporting it, I don't know what was done to the engine. I have had power reverse gears that did not creep. The crossheads on those do not remain stationary. However, I don't watch them all the time; I have looked out now

and then and have seen them work a little back and forth when they did not show any signs of creeping by the exhaust; that is, there was a certain amount of back play. It would not make any difference. What little they were working would not work enough to change the position of the valves so you could notice it on the exhaust. The manual reverse is more economical than the power reverse, because you can maintain at all times the true point of cut-off, and the effect of that is that the fireman can fire his engine more economically and keep his fire in condition to meet the demands, and it does not waste any coal. Taking an engine that is creeping all of the time, it is just as if you are running an automobile that is hitting on two or three cylinders. I have been noticing that fact ever since we have had the power reverse. I presume 10 or 12 years. And that condition has continued all the time—not steadily, but off and on. I can tell the amount of coal used by looking at the coal pile. I cannot tell approximately to the pound, but I can tell from about what is left in the tank. On occasions where the power reverse has crept, I judge, I use a couple more tons of coal than I would have if I had had a manual reverse gear. As to how frequently that happens with power reverse gears, I could not tell; she might go along for two or three months and you don't have any trouble with her at all, and for three or four days, a week, you might have some trouble with her until you get her fixed again. I don't say that it is an everyday occurrence that they creep. I never report any waste of fuel due to creeping because you don't
561 have to report that. If an engine does not steam and wastes fuel, you report her and it is up to the roundhouse to adjust her so that she does steam. I would not report a loss of two or three tons a trip for the reason that when we report her creeping the mechanics around the roundhouse know what is happening. To the question, "They know a great deal more than we lawyers?" the witness stated, "Well, I don't know. Some of you think you know a lot." I used the manual reverse until the class Z were equipped with the power reverse and the J's came here with power reverse.

As to the heaviest engine I have used with manual reverse, I don't know the weight of the class Z. Some of them were around 200,000 pounds, or maybe a little less or maybe a little more. For the purpose of the record it was shown that 209,500 to 214,000 pounds is understood to be the weight of the Z engines. The lightest engine I have operated was a class C. (The weight of the type C engine was not developed at this point in the record.) I would say that it takes more power to throw over a big engine than it does to throw over a little one.

There is a counter-balance spring to equalize the weight on hand-throw engines. I never threw one over that did not have a spring on it, therefore, I don't know whether there would be weight on the lever if there was no spring. This counter-balance spring equalizes the weight. I never had a spring break and, therefore, do not know

whether a broken spring would throw any weight on the lever. I have a spring to hold the dog down in the quadrant and I never had one break, therefore, I don't know what would happen if it would break. That spring causes a tension which I have to overcome when raising the dog; there is a certain amount of tension on
562 the spring that you have to compress to raise the dog. If your spring broke you might not be able to unlatch it at all. I don't know how much compression it would take to compress the broken parts of that spring. In answer to the question, "Mr. Herrick, when you took the examination for engineer or fireman, did you tell them then that you did not know what would happen or how you would fix so and so unless you had actually had it happen to you?" the witness stated, "I did not tell them what I would do in case of a break-down. If they asked, in case of a break-down, what would be done, I would tell them I would remove the broken parts and replace them if I could." In reply to the question, "Did you ever tell them that you did not know unless you had had that happen to you?" the witness answered, "No." To the question, "Why do you take this attitude here, that you are not going to tell us anything unless you had actually had it happen to you?" the witness replied, "Because I have taken an oath here to tell the whole truth and nothing but the truth, and I am not telling anything that did not happen by practical experience and that I know is the truth. I am not going on the supposition of what might happen or anything of the kind. That is not the truth." Witness was here advised that there are certain questions that are proper for counsel to ask even though 'you have not had the actual experiences yourself, and if the yask you improper questions your counsel will take care of them, so that, unless there is objection, whatever question is asked you will be expected to answer it."

I have had very little experience with dry valves. I have worked on engines with dry valves, but not of late. When I first came here the R's used to slide valves, and I beliee that is the only engine we have left with slide valves. I never had any experience
563 with them getting dry, not in my time, because I never ran very many of those R's. My experience with dry valves has been with engines equipped with both the manual and power reverse lever. A dry valve has a little effect on the lever. It makes a little more pull on the lever. As to whether I would observe the pull when I unlatch the lever, well, I presume there would be a little more pull and if I had the engine perfectly lubricated she would pull a little different.. There would be more friction there. I mean if the valves get dry, it creates more friction. To a certain extent the drier it gets the more friction it has, and the greater the pull. There is a limit to everything. With respect to knowing there is a limit to that, well, there is always a top to a ladder, and there must be a limit to that. She would pull so hard after she gets so dry. I have never had that experience. To the question, "You have some opinions on

some things", the witness replied, "He just told me I had to give it to you. He just told me I had to answer your questions as near as I can."

I presume if the equalizing spring broke it would put a weight on the reverse lever, according to the theory of counsel, but not according to mine. From my knowledge of a locomotive, if the equalizing spring broke, would it cause a weight to come on the end of the reverse gear—well, I don't know what it would do on a Baker type gear, and on a Young gear I don't know what it would do. I don't think there would be much more pull, if there would be any, than there would be on the Baker gear—I don't know. On all hand reverse you have a counterbalance spring. If the spring broke, I am not certain whether or not it would put a weight and cause a pull on the hand lever. They told me when I went to school that the equalizing spring equalizes the weight. They never asked me the question as to what would be the effect of taking away the spring or told me anything about it, so in the absence of that, I don't know what would happen.

H. HERRICK, on redirect examination, testified:

It is my idea that the different kinds of valve gear might make a difference in the proposition as to whether or not a breaking of the equalizing spring might make a pull on the lever, because there are certain kinds of valve gear where the whole weight falls the one way. With other kinds it is more equally balanced. Just like that [illustrating]. As to whether it makes any difference as to the position in which the valve gear happened to be set at the time the spring broke it is my opinion that depends upon what make of valve gear it is (T. 2030–2051).

565 H. PROEBSTLE, locomotive engineer for the Chicago & North Western, residing at 4825 North Kedvale Avenue, Chicago, Ill., age 45, testified: I have been in service as a locomotive engineer since September 29, 1909. From June 29, 1906 until September 1909, I had been a fireman. As an engineer I have operated in work-train, switch, special delivery, and hot-shot transfer service, around the city of Chicago, the North Western and foreign yards. This was all in the Chicago switching district. When I say foreign yards I mean making delivery to foreign road and depots. I operated locomotives equipped with hand reverse levers until after the war when the North Western got their first lot of 2600 switch engines from the Government. I think that was about 1918. I have operated the hand reverse on class M, M–1, R, R–1, and Zulu types of engines. I ran a class A passenger engine a few times with a hand lever. The Zulu is the class Z road, freight engine. I have never had any experience with them in road service. Some of them are used as switches in the yard from time to time. Some of our transfer jobs are faster than any road jobs and I have used them in transfer service. I have never seen a hand reverse on one of those

engines that I couldn't get over myself without the assistance of anyone. There has been no physical effort on my part in handling them. As a general rule, I tip them over with one hand and at times with two hands. It all depends on whether I am sitting down or standing up and in which direction I am operating my locomotive, that is, with manual reverse lever. On an M–1 switch engine if I am running the engine ahead and am sitting down, I sit on the seat with my arm on the armrest looking out. When I get a kick sign the lever might be in back motion, in which case I will reach over, tip her over in the corner and widen on it. As she increases her speed I will reach down and pull her up about three or four notches. It all
566 depends on how far we are going to kick the car. If I get a stop sign I shut her off and set my brakes.

If I am working back with an M–2 I straddle the seat in this way [illustrating], reach over and throw her ahead, pull her up, look out the front window or out the side of the cab; it doesn't make any difference.

If I am backing up I will sit this way at times [indicating] reach over, throw her over with this hand, get my throttle, open her up, and sometimes you have it this way facing the back of the tank, with my arm on the arm rest. Our tanks are square but they are cut down, that is, the whole top of the coal hopper has been cut down and I can see over the side of the tank or over the tank. That all depends upon where the man is who is giving the signal; and whether it is on a straight lead or on a curve. If it is on a curve, coming out I can pretty nearly see him at all times through this window, and when he gives me a " go ahead " sign I will reach down, grab her, throw her over and look around. On a lead it is not necessary for anybody to be running around but ourselves as the yard is ours. This demonstration I have given is all a one-hand operation.

Sometimes I stand up. I never sit in one position over an hour and a half or two hours at a time because it gets monotonous. When I stand up it is with one arm on the armseat like this [illustrating], and if I am backing up I stand like this [illustrating]. I get hold of my lever, tip it over, look out that way [indicating] or turn around and look this way [indicating], generally I look out over the window. On the M–1 type of engine in a standing position I customarily use one hand. There is a difference between the M–1 switch engine and the R–1 and the Zulu. On an R–1 the reverse lever is alongside of you when you are sitting on the seat. There is no drop seat on the R–1 like you have on an M–1 and M–2 en-
567 gine. On the R–1 you have a stationary box, a standard box according to law and your reverse lever runs alongside of you. You can reach over while sitting on the box without getting off the seat and tip the engine to backward motion or to forward motion with one hand. The expression tipping the engine means reversing the gears. Working ahead with a type Z engine you can sit down the same way as on an R–1 but backing up you generally have to straddle the seats like this [indicating] and in that position

you may use two hands to throw her over. It is just a question of habit—sometimes we use two and sometimes only one. The operation of levers on those engines has had no effect upon me physically.

I have had experience with hand levers that became unlatched in the quadrant and went to the corner. One time while running a switch engine on a night shift at Proviso along about 1911 or 1915, I don't recall the exact date, I had oiled my engine and got into the cab to start to work. I put the lever down in forward motion, part way, the switchman got on the footboard and gave me a "go ahead" sign. When we had reached a speed of about 45 (4 to 5) miles an hour I reached down to hook her up. I let go of the latch and the reverse lever went to the corner. It just bounced down because I hadn't been going very fast. We were just going down the track to get a cut of cars and when we arrived there I got down and looked this reverse lever over and saw that someone had oiled the whole quadrant, so I said to the fireman: "Put on your gun." I took the squirt hose and washed off as much oil as I could with hot water then wiped it dry with waste, got some sand and threw it over the teeth on the quadrant, then I took the reverse lever and brought it back notch for notch and pulverized the sand. I did that about once or twice and by that time the conductor had walked up and said: "We are ready to go." That is the first and the last time I ever had any experience with the lever going to the corner in
568 either direction, that is, the manual lever. I have never had any other experience of a manual lever becoming unlatched by itself. I have never had a manual lever pulling away from me while handling it after having unlatched it.

I have used power reverse gears on the M–2, M–3, the Zulu and the R–1 types of engines. The Zulu is equipped with the Walscheart and the Baker types of gears. The M–2 and the M–3 have the Baker. As to the R–1, I am not so sure but I think it is the Walscheart. Those engines have the Alco, the Barco, and the Ragonett make of power reverse gears.

I don't know whether the R–1 engines have power reverse or hand levers, because there aren't any more of them around in my territory. With respect to maintaining a fixed point of cut-off when you hook up the engine equipped with power reverse gears; I have had several that would creep and have had them kick back when I tried to hook them up. I have also had the experience after hooking them up of having the lever moved, but the motion did not, and all of a sudden the locomotive leaped ahead. When I say the lever moved I mean the reverse lever moved when I moved it, but my point of cut-off did not change. I do not have in mind any particular occurrence of this, but I will tell you it happened so regularly on those switch engines that it would be a pretty hard thing to remember dates and times when it occurred, because sometimes it is an every-day occurrence and again you might go along for a week and not have it because you wouldn't have the same engine.

I will explain the extent to which you hook up an engine in switching service and under what circumstances. By hooking up an engine you are working steam expansively; you are saving coal and water, and in switching service if you are on the job any length of time you generally learn the nature of the work. Where I have had trouble with the reverse gear is where I would be drifting
569 down the lead with maybe three or four or ten cars; the conductor would be hanging on the side of the cars and all of a sudden he would give me a kick sign and when he would I would reach over and drop the lever and reach up and kick the throttle open quick, in order to start these cars down the track maybe 50 car-lengths. As the engine is increasing speed I reach down and I hook her up again and I have seen that lever bounce up and down from the center to the corner until I got my hand over and held it where I wanted it to stay. In this respect I am speaking of power reverse levers on the M–2 and M–3 switch engines. In transfer service I run from Chicago to Proviso, a distance of about 15 miles. However, if we go from Wood Street it is further while from 16th and Halstead it is still further. Then on the Deering jobs if you return via Deering, I think the round trip is about 50 miles, that is, if you come back via Evanston. It is just during this depression in business that I happen to catch these transfer jobs. Business is so bad I am back on the extra board. Some weeks you will catch three or four of them, some times only one a week, sometimes you only get one in two weeks. I myself have never had any experience with the co-called "creeping" of the reverse gears on transfer jobs, that is, with the Zulu-type engine. But I have had switch engines creep on the delivery jobs where we traveled pretty nearly as fast at times in order to make connections with some foreign road's train. I have had other difficulty in operating with the power reverse gear. I think it was in the winter of 1927, I was operating the midnight shift at Mayfair yard. The relay crew brought engine no. 2139 to me at that yard. It was pretty cold on this particular night. After operating this engine for about two hours I noticed I could not reverse it. The weather got colder from midnight towards morning. I got off the engine and opened my drains on the air reverse. I couldn't get anything out of them so I got some waste and
570 built a fire under it and water ran out. I got more waste and oil and put waste and oil all over the air pipes. The fireman and myself held a shovel full of coal and squirted oil on it in order to create a fire and heat up the drum, and when I thought I had melted what water was frozen in the air system I opened up the drains, started my pump, blew out the entire system and went back to work. We worked along and everything went fine for about two or three hours. By this time I discovered that my brakes were not holding as they should, so I stopped the engine and told the conductor that I was going to tie her up and see what was wrong. I said: "I can't take any chance on working down here because it is an incline yard and I haven't any brakes." So we stopped. I

got a monkey wrench and broke a few of the air pipes at various points on the air-brake system, and in places I found slushy ice, and in the smaller pipes I found solid ice. When I say I broke the pipes I mean I disconnected them. There was too much ice and slush in the air pipes to be drained, so I called up the roundhouse for another engine. I was relieved before the other engine arrived. The other engineer had to wait for its arrival. With that same engine during that same winter I tipped her over one night to the extreme corner, and when I went to take the lever and reverse the motion I couldn't move it, so with the assistance of the fireman and one of the brakeman and the shaker bar we turned the motion over by hand, and I wouldn't put the engine in the corner any more that night. That engine was equipped with either an Alco or Ragonett power reverse and is engine no. 2139. On the night during the winter of 1927 that I referred to, the brakes were freezing also, distributing valve and all. It was also freezing around both reservoirs. I can't say where the water came from in the air pipes. On that occasion we had a complete engine failure (T. 2051 to 2067).

571 As to using power reverse gear for braking purposes, well, in the winter of 1928 I was working with a manual reverse in the Erie Street coach yard in switching service. I got a signal to go ahead from the conductor and proceeded up through the yard. When I got to the lead I saw that the switches were lined up for me. In the coach yard we generally step around pretty lively. While I was pulling out of this lead, another engine, three or four tracks over, started out. I looked up the lead and saw I still had the line up. I whistled this other man down as I was getting very close to fouling his track. I whistled him down and had my power shut off. My throttle was shut off. I started applying my brakes and sand. When I saw he was not going to stop and I was going about four miles an hour, I reversed her. I released my brake and widened down my throttle and started my engine and about six cars in the reverse movement. If I had not done that, I might not have been here to testify. That yard has tracks running into a lead. Here is a lead [indicating], and there are switches all along the lead, and the tracks all run down in here [indicating]. The track the other engine was operating on and the track I was on ran into the same lead, although there were cars in between the other engine and mine, that is, part of the way. If I had had power reverse, I could not have reversed the engine in the time and the space I had, the reason being that I could tip the hand reverse lever over in a second if I had to, while with the power reverse it takes longer. In other words, I can reverse an engine quicker with the hand lever than I can with power reverse, that is, with the switch engine I was running. As to whether it would have made any difference if I had had something besides a switcher, I don't know. As to how close this other locomotive came

572 to me, well, the back of his tank just cleared the right front corner of my beam, and at that time my engine was going

south in the clear from him, which was in the opposite direction in which both of us were going when we started out. Another instance in which I recall having used the hand reverse lever in emergency for braking purposes was in either 1916 or 1915, when I was working in a job at Proviso, which was called the bulk job. We switched grain all night and I had an R–1 engine with a manual reverse. We went down and got a cut of cars and were switching up and down the lead. I pulled up into the clear of track no. 6, because the track 6 switch was against me. The yardmaster walked over from the shanty and threw the switch and gave me a highball. I had started up the track which was our switching lead and just as my locomotive had passed, that is, just as the fireman's window passed these cars, he hallooed, "That will do, Hank." And just at that moment I saw the flash of a locomotive going by me on the fireman's side, through the window, through the flash of the fire-box, through the combustion tube. The minute he hallooed, "Stop", I set the brakes, and being winter weather I generally have the sand on, pulling out with a heavy cut, to keep the engine from slipping. I set the brake and just before this R–1 stopped, I tipped her over, released my brakes and widened on her, but I did not get into clear. I will demonstrate how I threw the engine over on that occasion. "I am pulling out. The engine is going ahead. When the fireman hallooed, 'That will do', I got my sander on, shut the throttle off and set my independent air-brake valve on this R–1 engine. She only had the old 92 brake valve. And just as the engine pretty near stopped, or maybe before she stopped, I released the brake and grabbed the lever, tipped it over and widened my throttle, starting my engine in the backward motion, but I did not do it quick enough. I didn't have time." What
573 happened was that the left back corner of the tank of this other engine struck my pilot beam—not ahead of the engine but on the inside of the engine. And when I was backing up I felt this obstruction and shut off my throttle and we both stopped, but I had pushed him over far enough that the engine and tank separated. I got down with my torch to see the extent of the damage. This other engine was on track no. 6, known as a running track at Proviso, used by engines going back and forth from the roundhouse. My engine was on a lead in yard no. 2, which lead crosses tracks 4 and 6, and then there was another connection where we went up into yard no. 1, and then down through some crossovers to the roundhouse track and over some more and up to the roundhouse. This accident happened at the point where the track I was on crosses track no. 6, or near that point. I had pulled to track no. 6 when this man threw the switch for me, but I stayed in the clear until I had the switch and I had a perfect right to pull out after I got the lead. When I got down with my torch to see what damage had been done to my locomotive, there was standing over on track no. 2 a passenger train, and I saw the crew looking

their coaches over to see whether the tank which had tipped over on to this main line had come into contact with any of their passenger cars. I don't know what passenger train it was, but I think it was the night Freeport. When I went up and looked at it, it appeared as though the coaches cleared the tank about three inches. The trucks of the tank were off the tracks. From my experience in operating the power reverse gears I would not have been able to have brought my engine to a stop and reverse it as quickly as I did. As to my experience as to whether or not in a day, with approximately the same size engine, I do any more switching in a yard with an engine equipped with power reverse than
574 I do with one equipped with hand reverse—well, there was one case at Proviso a year ago last winter when we went to supper. There is a rule when you are in to supper, if there is any way you are in the spot. In other words, the crew had overslept and while we were in there sleeping, a lot of work piled up in the yard. The yardmaster stiff came up to me and when we went to work and said, "Dutch, shake your leg, will you? We overslept and there is a lot of work here." I said "O.K." and went down to get a cut of cars. If I remember, I think we switched some 80-odd cars. Anyway, it was between the 80's and 90's, and I think we did it in 32 minutes. Of course, that is not an everyday occurrence. On that occasion we had a power reverse class M–4 switch engine. I can switch just as many cars with a hand reverse as I can with a power reverse.

As to how I feel at the end of a day's work when working an engine equipped with a hand lever as against one equipped with a power reverse; well, with the old switch engine, I never saw a day that I could not go fishing or hunting after working all day or all night, if I wanted to, or work on my place. But with the 2600 "M–3" switch engine, backing up on a lead job, my right arm gets tired and plays out, because I do practically all my work with that one arm; it is nearly impossible to run the engine in any other way. This last-mentioned engine is equipped with power reverse gear. The old type switch engine was equipped with a manual lever. I don't say that this engine equipped with the power reverse is harder to work with. I say my arm tires, because I do all my operation with the one arm. As to whether it would be different if the "M–3" were equipped with a hand reverse lever; well, I never ran one of those engines with such lever, and I don't know whether they could be equipped with the manual lever with the present cab, I don't think so. I am not enough of a mechanic to know what
575 they can do with these manual reverses. My view with respect to the safety as between the engine equipped with hand reverse and one equipped with power reverse; well, if they were going to build engines that I was going to operate and for the safety end of it I would take one with a hand reverse lever.

My experience as regards my ability to maintain a fixed point of cut-off with the engine hooked up, is that I know just where my locomotive is at all times, and my cut-off too. As to what I have found relative to the efficiency of locomotives equipped with the hand lever as compared with those equipped with power reverse gear; well, with a creeping lever your point of cut-off is moved from the various positions either by lengthening or shortening the travel of the valve—lengthening increases the exhaust, causing more steam and a waste of fuel and water. With the hand reverse that lever stays where you put it and my point of cut-off is at that one point until I move that lever.

I have never been injured with the reverse lever, nor seen anyone injured.

(At this point the hearing was adjourned until the next day.)

June 16, 1931

As to whether I had any physical defects at the time I entered the engine service of the Chicago and North Western; well, after I was promoted to engineer I had five attacks of appendicitis in one year. I did not go to the doctor until the last attack. (Further inquiry along this line was not (T. 2067–2082) pursued because of objections by opposing counsel and adverse rulings by the examiner.)

576 H. PROEBSTLE on cross examination testified: I am not a member of either of the engine service brotherhoods. After an engine has been broken in it takes no physical effort to handle the manual reverse. We do not get them when they first come from the shop. I never found a lever so stiff that I couldn't move it when I wanted to. Sometimes I have to take both hands. At times I use both hands and at other times only one. It doesn't require two hands. I would not say that I never had an engine which required two hands to reverse the manual bar. I have used two hands on some of them to get them started out of the corner. A manual lever that is in the extreme corner is harder to start than if she is hooked up at the point of cutoff, but it is not so hard that you have to strain yourself to get it over and by that I mean that I have never strained myself so as to cause any injury. I don't know what makes it so hard to start out of a corner. I don't think the weight of the valve motion or the parts of the valve motion that you have to move have anything to do with it as there is a counter balance on the engines to take care of that and they are balanced. If the counter balance on my engine is not in adjustment I adjust it and I will say that possibly I have had them when they were not in adjustment, that is, some years ago. Even with an adjusted counter balance I don't know what makes it hard to get the lever started from the corner. I have found that the lever moves easier over some parts of the quadrant than others. As to whether that is because of the action of the counter balance spring—that applies to anything; after you have started the movement it will move easier than it did from a standstill.

At different places on the quadrant the counter balance spring acts differently. When you are coming up the tendency of the
577 counter balance spring is to help you over the center, that is what it is there for and when you get to the center you have to compress it in order to get it back to the corner so there is not an even pull all the way over the path of the quadrant. In answer to the question: "Did you say a moment ago that you compressed the other one, meaning a second counter balance spring?" Witness replied: "I don't know which one it is but there are two down there and one does compress. Otherwise they wouldn't have two down there. I have never to my knowledge stood down there and watched them." I understand that you have one that helps one way and one that helps the other.

As to whether an engine is harder to reverse when you have steam in the cylinders, well that applies to different conditions of your work. I have in mind a switching service where you receive a stop sign. It all depends upon the load that you are pulling. After you apply your brakes the load will coast your engine down the lead with the brakes set, and by that time all steam in the cylinders is ex'austed. In making a flying switch of some cars with the manual reverse lever I have reversed the engine in order for the head man to get the slack on the train in order to get the pin with the throttle half open and better; I tipped her over and went the other way and got away, and the cars went down one track and I went down the other. Where it would be harder to reverse a manual lever would be pulling out with a train or taking the slack of a train, compressing the slack, and then tipping it over. But I always open my cylinder cocks before I attempt to tip her over when I have taken the slack. I have never had to open the cylinder cocks when there were people around. If there were any around I would ask them to step aside. On these transfer runs and also in the yards I hook up the engine, sometimes using two hands, it all depends. In reply to the question as to the high speed at which you have handled the
578 lever witness referred to a test run where the engine was equipped with a power reverse on which he maintained speeds of 40 to 50 and 55 miles an hour and the speed at which he was going when he last hooked up the engine lever was about 15 or 18 miles an hour. There is a certain amount of pull with a manual lever but I have never had that pull take a lever away from me. If I let go of the lever it might creep down two or three notches and stop. As to whether it would go to the corner quickly would all depend upon how fast you were going. At the speed I was going in the instance referred to I don't think it would go to the corner quickly. As a rule I don't hook them up when moving any faster than 15 or 18 miles an hour. By that time I have gone far enough that I generally have the speed where I want it and the point of cut-off where she would stay, unless I am going to climb a hill and I will obtain my speed this side of the hill if space permits. I don't hook up an

engine at 25, 30, or 35 miles a hour. Even at 15 or 18 miles an hour I feel a pull on the lever to a certain extent.

I have told you about some trouble with the power reverse gears on the M–3 or M–2 class of engines, where the lever didn't hold in the position in which I put it. This is known as creeping and I have had engines that did that four or five times in eight hours and have had engines that never did it. In my work I sometimes have as high as two or three engines in eight hours. The lever remains stationery in the quadrant when the engine creeps. I have had occasions when the lever vibrated up and back on the quadrant, up to the center but I generally stopped it from going over. I have had that happen on numerous engines and I reported it as a rule. I don't recall the last time I reported it. To my knowledge I have not had occasion to report power reverse within the last month. Our road requires us to make out a report at the expiration of every eight hours that an engine works, whether you have the engine one hour or 15 minutes or eight hours, and I make out so many work reports in a
578 month's time that I don't remember when I reported anything on a reverse gear, that is anything special. I would say that at times the power reverse is maintained in satisfactory shape. I have never made a check as to the length of time power reverse was maintained in satisfactory shape, and therefore couldn't give an exact percentage and be truthful. In answer to the question: "Can you give us an estimate as to what you think is right and what you think when they are not right?" Witness replied: "Well, I have had them, say, three times a month, four times a month sometimes, and then maybe for a month I would have them and they would not do it at all unless I might get back that same engine. Some months you might have three or four power reverses that wouldn't be right and sometimes I would have one with which there would be very little trouble. I don't think that I have any criticism of the way power reverse is maintained on my road. I can't do as fast work with a power reverse when maintained in good shape as I can with a manual lever. I have never made an exact test as to the time it takes me to throw over an engine with power reverse but I do know that with a power reverse the air that operates it is slower than I can move my arm in pulling over a manual lever. I would say it is a matter of nearly a minute. It might be a little less. I have never tested it, that is with a power reverse. That is just a matter of opinion." In answer to the question: "Do you mean by that a minute for each time that you to reverse the power gear?" Witness replied: "From corner to corner, as I said, a minute or less, I am not positive on this." It takes about a second or two in an emergency to reverse a manual engine.

I don't think that I have operated over 20 different engines during an eight-hour period; it runs from 18 to 20 on these relay jobs—that is a rough estimate, I have never counted them. The reason I make that statement is that we have to put down on the back of

our time book all engines that are handled in an eight- or
580 nine-hour assignment on a relay. This relay work is taking the fresh engines out to a man who has had one for 12 hours or more or less. On this relay job I get the engines ready at the roundhouse and take them to their various points and bring back the engine that is to be reconditioned. Sometimes I take out more than one engine at a time. The fireman and I ride one engine and have the air coupled up with the rest which we are pulling. I would only report having operated one engine. When I stated that I have had between 18 and 20 engines on a relay job some of the 20 engines were pulled by another engine. I did not actually operate the 20 engines, but I have to operate all the engines from their standing point to where I am going to couple them up to the get-ready track. The engine that pulls the other engines from the roundhouse makes a run of from one mile up to six miles. I have only caught that relay job twice. I have never had any difficulty with power reverse on either of those two jobs.

My opinion is that the hand lever is more economical than the power lever. I worked chiefly with the manual lever from 1908 to 1918. Since 1918 up to the present time I have operated 60 manual engines to 40 power reverse engines. At the present time that 60 to 40 condition does not exist because the roundhouse I am working out of at the present time has no manual reverse engines running from it but I have only been there for about two or three months. The efficiency of the manual bar is greater because it stays at the point of cut-off where it is placed, thereby saving fuel and water. I have never been in road service. The longest run that I have made is a round trip of about 50 miles—25 miles in each direction, and I have made that trip with both the manual bar and the power reverse bar. I have never noticed wastage of fuel and water on that 25-mile trip.

I am making my stand from a mechanical point. I do not
581 mean that I am expressing an opinion. It is facts. On a short run there is not enough of an effect so that it could be noticed. My longest run is 25 miles, and I know if I weighed that coal when I started and when I got through there would be a difference and how I know that is because I know the manual lever stays where I put it and my point of cut-off is at one point at all times, until I move the reverse lever. With the manual lever with a point of cut-off in one position the fireman can keep a more uniform fire and pressure and water level. With a creeping bar where she creeps from one point of cut-off to another, when she goes from the hook-up point to a downward point there is more of a pull on the fire; if she goes down suddenly it will tear the fireman's fire all to pieces, and any time a fire is torn to pieces it requires more coal to get it back into condition, and your engine uses more steam with your reverse lever in the corner and more water with your reverse lever in the corner than it does hooked up because your valve is traveling the full stroke.

With respect to power reverse creeping, I have had them where they would have gone over the center in the reverse motion if I hadn't stopped them. As to whether when it creeps back towards the center that makes the operation more economical, well, that all depends upon how far she goes back. If she goes back clear to the center it would choke the engine. In a reverse motion pretty nearly to the center it would slow up my train and slow up the engine. In other words, she would be choking herself, the engine would slow up and the slack would run in.

On this 25-mile run which has been referred to, I have never noticed more coal having been used with the power reverse bar creeping than used with the manual bar. I have never reported the condition of the amount of coal as we are not required to make those reports. We are instructed in pure economy and if it was a wasteful condition as to fuel to such an extent that I had noticed it, I
582 would report it. As to when I first formed an opinion that the power reverse is more wasteful than a manual reverse, well, I don't know that I could tell that. It is an opinion—It is a fact and I noticed that fact with the first creeping engine that I ran. However, I don't recall having mentioned it to anybody, nor do I know that I ever discussed this wastefulness of the power reverse with anybody. I do not know that I ever mentioned it to a traveling engineer or road foreman of engines. It is my opinion that the manual lever is safer than the power reverse. As to when I formed that opinion, well, I have always had that opinion. I think the power reverse is dangerous to a certain extent but have never reported that condition to the company nor mentioned it to a road foreman of engines. We have traveling engineers, and if there is a dangerous condition on an engine we would report it to him; if an engine is creeping we do report them. If the engine I am operating is in a dangerous condition I would report it to the traveling engineer. I have never reported that power reverse was dangerous (T. 2082–2108).

583 With respect to my previous statement that all engines operating out of this roundhouse where I am now employed are equipped with power reverse, I will have to withdraw it, as there is one engine there, the shop engine, that operates around the back shop, and which is equipped with a manual lever. All engines on my division do not work out of this particular roundhouse. On my division, I don't know the proportion of the engines with which I am familiar. It was about 1918 that we first got switch engines with power reverse. They were engines that we received from the Government at the expiration of the war. To my knowledge, the company has not put reverse gears on any of the old switch engines. Switch engines with manual bars have been discontinued and ones with power reverse have been brought in, to some extent, so the fact is that since about 1918 the proportion of engines with power reverse has been increasing.

H. PROEBSTLE, on redirect examination, testified:

With respect to the amount of coal consumed on a lever engine and the amount consumed on a power gear equipped engine that is creeping, I have never had any occasion to take any particular notice, in any way to compare, or make a report on the amount of coal consumed as between the two types of levers, it is only from my mechanical viewpoint (T. 2108–2111).

L. E. ELLIOTT, employed as water engineer on St. Louis-San Francisco, residing at Springfield, Mo., testified:

I have been connected with the Frisco lines in the capacity of water engineer for 11 years.

I will briefly outline my experience. I graduated from Pratt Institute School of Science and Technology, in Brooklyn, N.Y., in 1909; was employed as chemist by the Astoria Light, Heat and
584 Power Company until the latter part of 1911; was then employed as chemist and material inspector by the Chicago, Burlington and Quincy Railroad, having to do with general analytical work; was employed by the Wabash Railroad from 1913 to 1920 as chemist and water engineer; from 1920 to the present time have been water engineer on the St. Louis-San Francisco. As water engineer I have complete charge of the treatment of water for locomotive use for the prevention of scale, pitting and the care and handling of the water from a foaming standpoint; am adviser to the master mechanics as to the water conditions on their divisions. My department consists of three traveling chemists whose assigned duties are supervision and inspection of the treating plants and water supplies, the collection and analysis of samples of water for the control of the treating plants, and collection and analysis of samples taken directly from boilers of locomotives to indicate the condition of the water in the boiler, both for absence of scale forming salts and an indication of concentration of foaming salts in the boiler. These men are constantly engaged in this particular type of work.

With respect to analysis of the gauge cock samples, at stated intervals traveling chemists visit the various terminals and collect samples directly from the boilers for the determination of dissolved solids or alkali salts, so as to advise with the enginemen as to the condition of the boiler upon arrival. These anaylses are tabulated, showing the dissolved solids, hardness and alkalinity of the water, together with the engine number, name of the engineman, date collected, and terminal from which the engine was dispatched. If any of these samples show the alkali salts high enough to indicate an approach to the foaming point, the chemist gets in touch with the engineman, shows him the analysis, calls his attention to the necessity for addi-
585 tional blowing off, and for comparison shows him the analysis of water from the boilers of other engines from the same terminal that arrive in better condition. The complete data sheet is given to the master mechanic and road foreman who discuss the in-

formation with the various engine crews. Should an engineman bring his engine in in a condition indicating an approach to the foaming point, he will be called upon to make a statement and account for not giving the engine the proper care.

I was never actually employed as a fireman or engineman but put in a lot of time riding locomotives in demonstrating the practicability of the use of the blow-off cock to prevent foaming; in so doing I thought best to qualify myself as a fireman and make the necessary student trips and accumulate enough actual firing experience to be able to fire an engine over any operating district, thus being in a better position to discuss locomotive handling with enginemen. In doing this work and in riding the various locomotives, I became familiar with the various practices involved in pumping the boiler and in general locomotive operation. In other words, I thought it necessary to take a course to familiarize myself with the "lingo" of the enginemen and firemen so that I might talk their language.

Judging from the usual standards of the American Railway Engineering Association, the water supplies on the Frisco vary from non-scaling and non-foaming waters to very hard waters, high in natural foaming salts. A large percentage of water used is considered reasonably good boiler water, that is, it contains some scale-forming salts and has some foaming salts in it. The scale-forming salts are neutralized by the addition of the proper amount of chemicals. About 3 percent of the water furnished for locomotive use on the Frisco is bad water from a scaling and foaming stand-
586 point; about 5 percent is rated as "fair" water and the remainder is rated as "good" to very good." All districts have enough supplies requiring treatment that a blowing-off program is in effect.

Foaming is a condition brought about whereby water is carried over to the cylinders with the steam. A complete definition of foaming that satisfies all chemists and engineers has never been given. I think it is sufficient to say that foaming is brought about by the concentration of alkali salts in the boiler to such a point that the surface tension of steam bubbles increases to a point where, when they burst at the top of the water, the water from the bursting bubbles entrains with the steam and is carried into the cylinders. This condition is aggravated by suspended matter in the water. Foaming is not a condition that suddenly confronts the engineman without a warning. It is first indicated by a murkiness in the water glass. At about this time the steam whistle will change in tone and will be a positive warning. The next indication is a slight movement of the reverse lever and a change in the sound of the exhaust. All of these warnings are familiar to any engineman and if he is reasonably alert he can positively avoid actual foaming by liberal use of his blow-off cock. This, you understand, removes the highly concentrated water from the boiler, it being replaced by fresh water from the tender. Foaming can be prevented. In order to prevent foaming, our enginemen have been educated to use the blow-off cock

sufficiently to prevent the concentration of alkali salts reaching a foaming point, which point has definitely been determined by actual road tests. By this I mean test trips were made and the engine allowed to get into a foaming condition, and samples collected from the guage cock and analyzed to determine the concentration of alkali salts at which foaming took place. From these tests and from calculations based upon the analyses of the water supplies,
587 a definite blowing-off program was established. This program consist of a minimum required blowing-off in minutes over the subdivision, with the modification that should the operating conditions require it, additional blowing-off must be done so that the engineman knows his boiler is in proper condition for an extended locomotive run over several divisions or to be immediately turned back from the terminal over the same operating district. This matter of instruction is supplementary to the engineman's experience in handling water on his division. On certain operating districts, antifoaming compound is furnished, which will permit a higher concentration of alkali salts in the boiler before foaming takes place. This higher concentration has been determined by actual road tests in like manner as previously outlined.

I have complete charge with reference to the treatment of water on the Frisco. Instances of foaming or trouble with water are investigated by me or under my direction by members of my staff. Reports are made to me regularly and in due course with reference to water conditions and foaming conditions on locomotives on the Frisco. As water engineer I have direct supervision over all such matters as that. I have three assistants. Four men can tell whether there is any foaming on the Frisco at any time. They put in all their time riding around looking for the condition of water in the boilers. The reports of the inspectors are on file. This campaign has resulted in approximately the entire elimination of foaming troubles on our railroad. We promptly investigate any complaint from enginemen that a particular water supply is giving them trouble. It is obvious that indifference or carelessness on the part of the engine crew would bring about a bad condition, but they have had, and have now, ample opportunity to learn the proper method for the control of foaming, by discussions with their road foremen and division chemists and by attending fuel meetings and better service
588 meetings where these problems are fully discussed. I don't go to all of these fuel and service meetings and discuss water troubles and foaming troubles with enginemen, but I do go at irregular intervals and ask for this kind of discussion. The amount of blowing-off done will be determined by conditions met on the particular division and at any given time, that is, when the engineman knows that he is going up against a ruling grade or difficult piece of track, he will prepare his boiler in advance by sufficient blowing-off to put the boiler in condition to meet the maximum demands made upon it.

Frequently I ride on engines in connection with this blowing-off program and instruct enginemen as to how they must handle their blow-off cocks under various conditions. Assuming that a man is going up against a difficult piece of track, such as a ruling grade, or something of the sort, he will blow his boiler out ahead of the maximum demand on the engine so that there will be no difficulty about maintaining water-level and so on. These blow-off levers are located in the cab, directly in front of the engineman so that if he is sitting on the seat-box he can take hold of the blow-off lever and be in position to know the level of the water in the water glass, and at the same time know if he is going to do any damage to equipment or injury to a person on the ground. There is also one such lever on the fireman's side. There were no engine failures due to foaming reported on the Frisco lines in 1930, nor any so far this year; 1927 was the last one, and I believe there were two that year. When there is a delay of five minutes due to some irregularity, even though the time is made up, it is recorded as a delay, whereas if the time is not made up it is a failure. I think there is a differential in time between five minutes on passenger and a greater time on freight. I can't say what the freight figure is (T. 2111–2125).

589 FRANK ELLIS, general air brake instructor, St. Louis-San Francisco Railway, residing at Springfield, Mo., testified. I have been in the service of the Frisco Lines for 35 years. I served one year in the roundhouse; fired locomotives for four years; served 17 years as an engineer, 12 years as road foreman of equipment, and one year as general air-brake instructor. In my present duties as general air brake instructor I supervised the condition and operation of air-brake equipment on the Frisco lines, particularly in connection with the operation of trains. I also look after maintenance of air-brake equipment and in this connection I come in contact with shop, train, and engine men. This work requires that I ride locomotives a substantial portion of my time. I frequently run locomotives in connection with this work.

As road foreman of equipment my duties consisted primarily in instructing enginemen in the proper method of handling locomotives. As assistant to the master mechanic I inspected and reported condition of locomotives in service. I instructed enginemen and firemen in the proper handling of locomotives, and while on the road I was in direct charge of train and engine men.

I had but little experience as an engineer with power reverse gear. On my division at the time when I became road foreman we had but one engine equipped with power reverse gear. During my 12 years as road foreman of equipment, however, I have had a good deal of experience with power reverse gear and have been called upon to operate power gear and instruct enginemen in the proper operation of both power and manual reverse gear. During the last four years of my experience as road foreman most of the engines on my division were equipped with power reverse gear. I understand what

is meant by the word creeping as it applies to power reverse gear and have had quite a little experience with this creeping. I recall
590 two cases which caused delay in train operation. In the spring of 1926 engine 4004 was out of Neodesha, Kans., on train 32. I was riding the engine and operated the engine part of the time over the division. This engine was equipped with a Lewis power reverse gear. This gear would go from center to front corner and then back. With the reverse lever in the cab cut back to about 25 percent we were unable to handle a full train on account of this condition. In 1928 the master mechanic at Tulsa, Okla., called me to ride a freight engine cutting in on train no. 4. This is a fast passenger train and on account of trouble with the power reverse gear the engineman had advised that the engine on no. 4 would not be able to go beyond Tulsa. I met the incoming train at the depot at Tulsa and found that the trouble was due to the power reverse gear creeping. I decided that we could make better time with this passenger engine on the train than with the freight engine and decided to let the passenger engine go through. This was no. 1514 mountain type passenger engine. I rode this engine from Tulsa, Okla., to Monett, Mo. On three different occasions on the 142-mile division this gear actually put the valve motion past the center and made the engine buck. The lever in the cab was set about at 25 to 35 percent cut-off. In each instance we had to partially close the throttle and reduce the train speed with the brakes from about 60 to 30 miles an hour. When the speed got down to somewhere around 30 miles an hour the gear would adjust itself and we could then widen out and pick up speed. The gear was a type E Franklin. After this had occurred three times we decided that the safe procedure was not to attempt to run the engine in excess of 40 to 45 miles per hour and we handled the engine in this manner over the remainder of the division. I advised the terminal at Monett that we would have to have another engine at that point and we set this engine out at Monett.

I have frequently been on engines where the power reverse
591 gear was creeping. When operating a locomotive I would not immediately notice this creeping. I have had other experiences with creeping other than these two cases just referred to. This creeping manifests itself by the engine going lame. It has been my experience that enginemen usually wait until the engines go plenty lame before they report a condition of this kind. When an engine is being worked at a long cut-off you would not notice creeping much unless you were in a position to see the air piston. If an engine is operating at a speed of around 15 to 20 miles an hour with from 35 to 50 percent cut-off, creeping would be indicated by the engine going lame. This lameness would be indicated by the valve or exhaust being irregular. I have been directed on occasions to ride locomotives that enginemen have reported as being lame. On a few occasions the master mechanic has directed me to ride engines that enginemen had reported lame. An inspection of the engine had not

disclosed the reason of this lameness. On some of these trips I found that the engine was not working properly on account of the reverse gear creeping.

On two occasions which I remember, power reverse valves were frozen. At Afton, Okla., I found out what was wrong with the engine. I didn't have time to find out between the time I got on at Vinita and Afton. I got on the train at Vinita, Okla., while it was pulling through the wye. The train does not stop at Vinita. The engine could not be reversed. The reverse lever could be moved from the front corner up about six notches and then back to the corner, but it wouldn't have any effect upon the valve motion. The reason I got on the engine at Vinita was that I had called up our train dispatcher to find out how things were going on the railroad,
and he told me there was some trouble with the engine on
592 train no. 2 so immediately after getting on the engine I asked
the engineer what his trouble was and he said the power reverse is broken. I asked him: "Are you sure it is not frozen up?" He said: "No; it is not frozen up. I have built a fire around it, and blowed air through it, and that part of it is all right. It is broken." I took his word for it as we had to go only 12 miles before picking up another engine which the engineer had ordered. After we set the engine out I went through it and found out it was frozen up. The other occasion where I had trouble with power reverse gear freezing up was on train no. 3 going into Tulsa, Okla. The water that froze came from the moisture in the air. The engine arrived at the terminal at Tulsa with the power reverse gear frozen.

My experience is that you cannot regulate or control the valve gear with the same exactness or precision on a power reverse gear engine as you can on a manual reverse gear engine. It has been my experience that an engine equipped with a manually operated gear running along hooked up say, about 25 percent cut-off, will respond to a notch with a greater degree of fineness than an engine equipped with power reverse gear, even if the power reverse gear is in 100 percent condition. After an engine equipped with a power reverse gear has been out of the shop for some time or some time has elapsed since the power reverse gear has been overhauled the gear will develop a certain amount of lost motion. The lost motion in the power gear has this effect: An engineer desires to increase the cut-off—he moves the lever one notch. The gear does not respond. He moves the lever another notch. The gear then moves to correspond to the two notches that the engineer has given the reverse lever in the cab, and also in most cases moves enough to take up the lost motion with this result. It is necessary for the engineman to par-
tially repeat the operation of handling the lever in the cab
593 back toward the center in order to get the engine working
somewhere near the desired cut-off. The longer the gear is in service between shoppings or overhauling, the greater the differential in the degree of fineness in operating the manual gear as compared with the power reverse gear. It has been my experience as a

road foreman that enginemen do not at all times regulate the cut-off with the degree of fineness they should with the power reverse gear due to these troubles.

I was an engineman for 17 years and during that time was injured with the manual reverse lever. In 1903 I dropped a reverse lever on my foot. I was handling a slide valve engine and she was very easy to handle. I wanted to move the lever from the center to the forward motion and I had my foot on a box placed at the front end of the quadrant. I threw the lever down and the corner of the latch struck my foot. This was carelessness on my own part in having my foot in the way. In my service as road foreman I have on several occasions observed men put themselves in positions where they might be injured if the reverse lever should go out of control. I made a practice to warn these men not to put themselves in that position. We have on our engines sufficient room so that there is no occasion for a man to put his foot on the quadrant or under the quadrant. I recall one case where I was riding on an engine pulling a high-speed passenger train. The engineer actually got his body in front of the reverse lever in order to hook her up another notch. He was not properly braced and if the reverse lever had gone out of control for any reason he might have been injured. This was an M-K-T 300 class engine on train no. 2. These engines run on our joint trains nos. 1, 2, 7, and 8 between Monett, Mo., and Muskogee, Okla.; 78 miles of this joint service is on the Frisco and 65 miles is on the M-K-T. In this case I tried the reverse lever on this engine from the deck and found she was not hard to
594 handle. She could easily be hooked up sitting on the seat box. At other times I have seen enginemen stand on the quadrant in front of the reverse lever looking at the lubricator while the engine was operating in high speed. Invariably I warned enginemen about putting themselves in positions like this.

With respect to my experience with reference to engines unlatching and going to the corner; during my 17 years as an engineer I probably had an engine go to the corner 2 or 3 times. I did not go with them as I didn't consider it was up to me to go with them. After it went to the corner I then placed myself in the proper position to handle the lever and hook the engine up to where I wanted it. It is my experience that engines go to the corner because the engineer doesn't properly brace himself. I usually thought this condition was due to not taking proper precautions. By that I mean enginemen might get into some awkward position to handle them and as a result, if a man is standing with his feet together, or even if he is sitting down, and does not make any effort to brace himself, he can't hold very much. While an engineman I never ran a signal on account of my attention at the time being taken with handling the reverse lever and during my 4 years as road foreman I never observed enginemen run signals while they were busy about their reverse lever.

A few times early in my experience as an engineer I found it necessary to call for help in making an adjustment about my reverse lever. I do not recall any time when it was necessary to get assistance on an engine that had been in service or that was broken in. By this I mean an engine that had been out of the shop and had made a trip or two so that the pins, valves, and working parts were properly lubricated. We usually make about 50,000 miles before anything is done with the valve gear. An engine averages about 4,000 miles per month. An engine will be in service a year
595 under ordinary conditions, after she comes out of the shop.

It is the practice on our railroad to break engines in before they are placed in road service. This is done to loosen up any tight bearings. Ordinarily, after this breaking-in the engines equipped with manual gear as in such shape they can be readily handled. If this is not true, then an examination is made of the engine to see why she does not move freely and this condition is corrected at the shops before the engine is put in road service.

I have operated a switch engine equipped with manual gear and while so engaged did not ever fail to observe signals or lose contact with the man on the ground who was giving signals. If I was switching and got a signal to move and for any reason I had to take my attention off whoever was giving me the signal due to moving the reverse lever or on account of anything else about the locomotive, before I started to make the move I always looked again to see if there was any change in the signal. In my opinion this did not result in delaying or slowing up the work. My experience in operating switching engines equipped with manual reverse gears has been that it was not necessary to get down on the deck of the engine to reverse it. I have heard the testimony given by witnesses in behalf of complainants with reference to the lubrication of valves and the working parts of valve motion. I have had personal experience with the hydrostatic and mechanical types of lubrication. Most of our engines are equipped with hydrostatic lubricators. The hydrostatic lubricator is located in the cab of the engine and within reach of the engineman and directly under his control. It has sight glasses showing the amount of oil in the lubricator and it also shows to the engineer the amount of oil being fed to the valves, cylinders, and air pumps. With this type of lubricator the engineman can observe at all times how much oil is going to the
596 valves. If the valves get dry, that is usually indicated on the manual engine by the reverse bar rattling.

I have found it necessary to stand on the quadrant in order to observe or adjust the lubricator. It is my opinion that the proper place to stand to observe or adjust the lubricator is on the deck of the engine. In extreme cases, on some of our locomotives where the lubricator is high in the cab, it is necessary to get up on the seat box and in this manner you are in the clear of the reverse lever. Enginemen can relieve dry valves by increasing the flow of oil through the lubricator. With a hydrostatic lubricator he increases

the flow of the oil to the dry valve by an adjustment on the globe valve attached to the lubricator. If the valves are very dry the engine should be eased off, the lever dropped, and the lubrication flow increased. The relief in this case is immediate. The result of operating an engine when its valves are improperly or insufficiently lubricated is, badly cut valve seats, valve rings or bushings and worn-out cylinder packing. In extreme cases cylinder bushings have been cut. On engines with manual gear dry valves will cause the reverse lever to rattle. On power reverse gear engines, dry valves are not noticed until the engine has gone lame. It is my experience that with manual reverse gear you can pick up a lack of lubrication quicker and correct it before substantial harm has been done. This is not always true on a power reverse gear engine. I have known cases where we have had engines with power reverse gears badly damaged on account of lack of lubrication, where the engineer knew nothing about it until he either arrived at a terminal or stopped at some station where he had a chance to observe the condition of the pistons. With respect to the filling up with dirt or cinders of oil holes on valve gear parts that are hand oiled I have had no trouble in the past eight or ten years due to the fact that these places have been protected with hair packing. I have had oil holes not protected with hair packing fill up on a few occasions after I had left the terminal. This was a matter, however, that was easily cor-
597 rected with a small nail or piece of wood such as a match to clean them out. After they were cleaned out and the oil got down on the bearing it did not make much difference if some dirt got down there so long as there was oil on the pins or bearings. If these oil holes were opened up before leaving a terminal and were oiled with hand oiler I never had any trouble. The only injury I ever had with the manual reverse geared engine was the one I heretofore referred to. I have never ridden on a locomotive where an engineer was injured in handling the reverse lever or as a result of any mishap or accident to a reverse lever. My accident was 27 years ago and I don't recall whether I lost any time as a result of the injury (T. 2126 to 2144).

598 FRANK ELLIS, on cross-examination, testified:

It was in August, 1901, that I started to run an engine and I was an engineer until 1918, at which time I was made road foreman. I served in this capacity from August 6, 1918, to August 1, 1930, at which latter date I was made general air brake instructor. The only occasions I recall vividly when I had an engine given to me to examine where the power reverse was creeping, were those referred to, one of the Lewis gear and the other of the Franklin E. I do not recall any other occasions similar to those. As I recall it, the trouble with the Lewis gear was due to the operating valve. In the old type of Lewis gear the valve was under the reverse bar and was a rotary valve. With the Franklin E type, after I arrived at Monett we tested the gear and found nothing wrong with it. The engine was

wanted in Springfield and so we let it go there on a freight train. As I understand it, the valve bushing was badly cut.

We have changed the valve mechanism of the Lewis gear and as I have not been on one of these engines for several years, I can not say whether any difficulty is being had with it. In fact I have not been on one of them since the change. I am speaking now about the engines that had the Lewis gear on them. The Franklin E type is operated with the hand lever in the cab, and on the occasion I have referred to as having had trouble with it, I did not find out what the difficulty was, except by talking with the master mechanic of the division at Springfield.

I have never been hurt or seen anyone hurt operating power reverse.

On the occasion I referred to, where I rode the engine from Vinita to Afton, after the engine was set out, I thawed it out. We
599 loosened up the valve and we could see the ice in it. As to where the water came from, I know that all air carries a certain amount of water. In this instance I refer to, the valve was practically solid with ice. The cylinder in the independent brake was not frozen, although that cylinder gets the air from the same reservoir that the power reverse mechanism does, and that cylinder is farther away from the heat of the boiler than the power reverse. I cannot give any reason as to why the cylinder in the independent brake did not freeze from the condensation of the air at the same time the power reverse froze. All I know is that it did not freeze. I do not believe that I ever had a case where the air cylinder froze on my brake system. This case referred to is the only one of which I have any direct knowledge of the power reverse cylinders freezing.

With respect to lost motion in the power reverse gear, it is also a fact that as an engine goes on and piles up her miles you get lost motion in the parts of the link motion, and lost motion in the fittings of the reach rod and in the lever and the latch. We do not permit a condition where the notches in the quadrant get rounded off near the top. There is some wear there though. All this lost motion of which I have spoken, in the manually operated gear, in the valve motion, has a tendency to make the lever rattle and vibrate, and there will be some play in the reverse lever. As to whether there is play enough to make it easy for the lever to jump out of the quadrant, that depends upon the condition of the latch in the quadrant. We don't let them get to that point any more where it will become unlatched.

To the question, "Isn't it also true that you do not allow the power reverse mechanism to get to the point where there is play in it?" the witness stated, "When an engine comes out of the shop, or the power reverse gear has been overhauled, the
600 pins have practically no lost motion, but after an engine makes a few trips there the wear starts. Now, you would not possibly notice it very much, but the more trips it makes the

more it is going to wear; and in the maintenance program we do not take it out for, say, a little sixty-fourths wear. But that gradually will get larger. But we do try to bring the maintenance up to a place where we will not have excessive lost motion." We can set a program to accomplish that by checking these power reverse gear parts for lost motion. As to whether there is creeping where the power reverse gear is properly maintained; well, in some cases—now, the case I told about on engine no. 1514, there was nothing wrong with the power reverse. At the time they did not know what caused it to creep, but the trouble was explained by reason of the valve bushing being badly worn. To a certain degree we have been able to overcome that trouble with valve bushings. The type E Franklin gear has a slide valve. The Lewis gear that we have has the same type of valve, a slide valve, that the other gears have. I have had no experience with rotary valves on power reverse.

I would not say that an engineer can in all cases tell when he has dry valves by the sound of his exhaust. As a rule an engine equipped with a power reverse gear goes lame before the engineer detects it. As to whether, before the valves will get cut, you can tell it by the exhaust of the engine, I don't think so; not enough to protect yourself quickly enough. Even when the valves are dry on an engine equipped with power reverse, there is nothing serious that happens to the lever in the cab. Sometimes it will jiggle back and forth about half an inch. That is because the power reverse gear starts to pumping, causing the floating lever to move the
601 bottom of the reverse gear in the quadrant. The operating lever of the power reverse in the cab is not connected directly to the reach rod of the reversing gear. All the operating lever in the cab does is to control the travel of the valve of the air chamber of the power reverse. My opinion that dry valves will change the position of the operating lever of the power reverse in the cab is that it is due to the connection between the reach rod and the floating lever. It will move the valve at the same time that it moved the foot of the lever in the cab. When that has hapened I have only on two or three occasions heard a small exhaust. That small movement is not particularly dangerous in connection with the lever in the cab. I believe the manual reverse is more exact than the power reverse, and to demonstrate that I heretofore said that when you move the power reverse gear one notch the piston may not respond and you have to move it another notch before it would respond, so that you have to move it two notches before you can get the response that you want out of one notch.

The notches on the quadrant of the power reverse are much finer than those on the quadrant of the manual reverse. Relatively speaking, one notch on the manual reverse would be equal in distance upon the quadrant to three or four notches on the power reverse, but would not have effect upon the valves. As to our standard manual reverse quadrant, while I have never counted the notches on

it, I would make a guess of 15 each way, that is, 15 from the center each way. And as to the power reverse quadrant, I don't know; I never counted them. I would say the quadrants on each of these levers would be about the same segment of a circle. The statement is based upon the view that the manually operated quadrant is longer and the power reverse gear is shorter. If they are set in a segment of a circle they would possibly fit it. I don't know exactly whether they would or not.

602 I have under my jurisdiction all locomotives on the Frisco system, which are about 1,000; and I believe there are 365 power reverse ones, and the balance manual reverse. I don't know exactly when we got the first power reverse. I think it was in 1916. Our only program with respect to power reverse being applied in progresively increasing numbers is that we have applied power reverse to certain types of consolidated engines that we put into yard service, that is, we have applied a certain number of power reverses in the last two years to engines that were reduced to yard service, and which were formerly operated in road service. I do not know why they have applied power reverse to them when they go into yard service. On some types of engines there is an advantage in having the power reverse over the manual reverse. And I refer particularly to the 900's, the 2–8–0 type weighing around 185,000 pounds on drivers. The cab arrangement on these engines is such that you could not class them as a switching engine and handle them properly with the reverse bar without making extensive changes, which probably would have entailed as much expense as putting on the power reverse gear. The condition that prevailed which prevented them from being operated with the manual reverse bar as a switch engine was that a man would have to sit behind the boiler at all times, with the reverse lever right here [indicating]. And in trying to handle this engine all day long in yard service he would necessarily have to be in this position [illustrating]. A man could not be expected to stay in that position all day. So we devised different means to get the bars in another position, but it was not practical, so we put the power reverse on. The bars as described would be straight up on the center. On this class of engine we have an 18-inch seatbox, and there was about 2 inches between the lever and the seatbox, so the lever would be approximately 20 inches from the side of the cab. When on center, this lever would be on about a level with

603 the engineer's shoulder. When it was in full forward motion the distance from the center to the end of the lever would be approximately four feet. By that I mean, if you move the bar from full forward motion to full backward motion, it would have to move about four feet. With reference to an improper position which I noticed an engineer take, that particular type of engine he was operating was a 300 class M–K–T engine, on which the lever is about 24 inches from the side of the cab and behind the boilerhead. The engineer in that instance was running along at a speed of possibly

40 miles an hour, and he desired to raise the lever up a notch. He stood behind the lever and pushed it in this way [illustrating] with his body or his back against the front end of the locomotive and against the boilerhead. I got over there and told him to get out and I took hold of the lever myself and put it where he wanted it. I considered that a dangerous position for him to be in. The lever might have come out of the control, and the biggest fact was that he was not observing what he was doing ahead. That is, he could not look ahead while in that position. If the lever had gone out of control, he could not have stopped it except with his body. On that type of locomotive I don't know whether or not it would have gone against him with force. The reason I thought it dangerous was because you can't tell just the force it sometimes does have, although I have never considered it a very great force. I considered it dangerous for a man to get himself into a position where he has no protection and allow a bar to come against him. I don't know what the bar would do. When the valves begin to get dry and you have a manual lever, an engineman can distinguish the difference between the usual rattling of the lever and something unusual. I would say this causes additional pull on the lever and causes the unusual rattle; the more friction there is the greater the
604 pull. In extreme cases, if you have a dry cylinder or a dry valve, that is, very dry, the procedure would be to ease off the engine and to drop down the throttle. In an extreme case there would be a hard pull on the lever. To the question, "And when a man undertook to unlatch that lever and let it down, he would have to do it with great care so as not to get into trouble with the lever?" the witnes replied, "An engineman understands when to do these things. To define that I want just to illustrate a little bit. An engineer who knows how to handle an engine does not depend entirely upon his strength to handle that engine. When the valves are dry or there is anything like that causing that bar to rattle, he feels it when he takes hold of it. He knows when to unlatch that lever. And to drop it a notch or to hook it up, it does not take much weight, and he knows he can take hold of it with one hand and do it. It is all in the handling of the latch. It may be dry, and if a man stayed hold of it and undertook to handle all of that weight, it might be hard to handle. But I would not consider them hard to handle." As to whether a man must be expert to handle one of those reverses, I would say that a man has to be an expert in order to handle the reverse levers. To the question, "Could a nonexpert get up there and handle the lever?" the witness replied, "Not with the exactness that I could."

If the manual reverse bar were unlatched and the engine in operation at 30 miles an hour, the lever would move, but I don't think it would be with considerable force with that speed. As the speed increases it is my observation that the bar will pull harder or move faster.

I never warned a man in a cab against the position he had assumed in operating a power reverse. There was one case where I warned a man. He was not in the cab. He was oiling an engine.

The gear was moving, and I don't know whether he noticed
605 it or not. The valve motion was moving (T. 2144–2168).

FRANK ELLIS, on redirect examination, testified:

In the case of the engineman that I observed on the M–K–T and where I took the reverse lever from him, I was standing on the deck and I got up this way [illustrating]. I got up and put this foot [indicating] against the boiler head and pulled the lever, using both hands and one foot, one foot being on the floor and the other being braced against the boiler head, standing on the deck of the locomotive. The handle of the lever was about four feet above the deck of the locomotive.

At the time I warned the man who was oiling around on the power reverse gear when the parts of the valve motion were moving, there was nobody in the cab. It was caused by the air pressure that was coming up, and the gear was coming up to correspond with the lever (T. 2168–2170).

606 J. L. RYAN, mechanical engineer, St. Louis-San Francisco, residing at Springfield, Mo., testified:

I was a machinist apprentice four years, 1911 to 1914. Locomotive draftsman one year, 1916, Southern Pacific; assistant dynamometer car operator one year, 1917, with the Northern Pacific and warrant machinist and engineering ensign in 1918. 1919 to 1922 University of Minnesota taking a course in engineering and part time with the Northern Pacific as mechanical draftsman and calculator; 1923 to 1925 dynamometer car operator Northern Pacific Railroad; 1926 to 1928, engineer of tests, St. Louis-San Francisco Railroad; 1929 to 1930, mechanical and test engineer and effective January 1, 1931, mechanical engineer.

As mechanical engineer I have charge of chemical and mechanical laboratory, the drawing room and engineering department with respect to locomotives and car design; engineer of tests who has charge of the road testing and locomotives, power plants and service tests; chief material inspector, also the inspection during the building of new locomotives and cars.

As to my duties with respect to the failure of reverse gear both mechanical and power; a report is made daily by the operating department of operation failures and equipment failures and I am one of those to whom the report is made. For 1930 I have a tabulation of reverse gear failures and related parts, such as valve motion, which shows a total of 11; 7 occurred on locomotives having manual reverse levers and four on locomotives having power reverse; and working that out on a mileage basis, there was one failure for 2,400,000 locomotive miles on locomotives having power reverse gears and one failure per 1,990,000 locomotive miles on locomotives having

manual reverse levers. To a request for the definition of "failure" witness replied: "Well on the report I referred to, anything that causes a five-minute delay or greater in road operation would
607 be included in that report. However, in making a check of the parts as a rule it was an out-and-out failure."

These 11 failures were: Radius bar end broken; lost pin out of eccentric and broken valve guide; reverse lever latch and bridle rod broken; broken tumbling shaft bearing; reverse lever latch bolt broke; broken combination lever; hot link block; broken valve stem; broken valve guide yoke; broken combination lever; broken combination lever. These failures which were with the power reverse were: Broken combination lever; broken valve guide yoke; broken combination lever; broken tumbling block. All other failures mentioned were on the manual reverse engines.

In 1929 there were nine failures on locomotives equipped with manual reverse gears, mileage 1,799,000 locomotive miles per failure. There were four failures on locomotives having power reverse gear or one failure to each 2,658,000 locomotive miles.

In 1928 there were five failures on locomotives having manual reverse levers or one failure to each 3,151,000 locomotive miles, and eight failures on locomotives equipped with power reverse gears, or one failure to each 1,266,000 locomotive miles.

The total failures for the three years 1928, 1929, and 1930 were on the manual reverse 21, or a failure for each 2,186,000 locomotive miles, and on the power reverse 16 failures, or a failure for each 1,903,000 locomotive miles.

I can not tell you how many locomotives were involved in this mileage in each of those years, but I can tell the number of locomotives we have in service now which are, 871 owned and 33 awaiting disposition. The 33 awaiting disposition are included in 871 owned. Of the 871, 334 are equipped with power reverse gear, leaving 504 not so equipped.

608 New locomotives purchased have been equipped with power reverse gears. Mr. Worman who was general superintendent of locomotive power but now vice president in charge of operations, determined what sort of gears are to be put on the engines. I might make a recommendation.

Certain locomotives in road service have been converted to switching service and includes principally our 950 to 989 class which are wide fire box consolidation locomotives; and 1200's to the 1225 and 1226 to the 1265, which are also wide fire box consolidation locomotives. The application of the power reverse gear was made primarily due to the cab arrangement. While entirely satisfactory for road service, when placed in yard service these engines were not so satisfactory. They have a wide fire box, limiting the clearance between the fire box and the cab side to such an extent that it is necessary to place the reverse lever behind the boiler head which gives a satisfactory arrangement for road operation, but not entirely satisfactory for constant switching service. It was considered that

to make the locomotive entirely satisfactory for yard service it would be a matter of trying to work out another cab arrangement, and, even so, I do not think that could have been satisfactorily accomplished because the room between the side of the boiler—that is, your side sheets and the cab side wall—is not sufficient to readily accommodate the application of a manual reverse lever and at the same time permit a man to operate. We have any number of smaller locomotives in switching service having small boilers and narrow across the side sheets which have ample room between the side sheets and the cab wall for the application of a manual lever and room to operate it. This could not be accomplished with the heavy consolidation locomotives. We have not purchased any new switches lately, the practice being to retire the consolidation engines from road service to yard service, and that was what occurred here in
609 connection with these engines about which I have been talking.

I frequently ride locomotives. I have done this for months at a time in connection with tests. In 1923 to 1928, or 1923 to 1925 it was a daily occurrence while 1926 to 1928 I did for months at a time. In the course of regular work as mechanical engineer I am called upon to undertake to work out adjustments in connection with operating difficulties in connection with power reverse. We have had a large number of complaints to the effect that the power reverse gear, this Ragonnet type E, did not respond or was not as sensitive as it should be, and with a view towards trying to overcome that, experiments have been made which did not prove entirely satisfactory. The gear is not as sensitive as it should be and in connection with holding them we at the present time are experimenting especially on the late long-travel valves, which these locomotives have. We get a burning action, to overcome that, we are using friction blocks. The locomotives delivered in 1930 had an 8½-inch travel with 1 1/8-inch steam lap, equipped with these blocks and within the last two or three months we tried removing the blocks, having chewed the tumbler shaft bearings rather badly, and we tried operating without them, but could not hold the gear and it was necessary to go back to the friction block. On locomotives built in 1925 and 1926 or 1923 to 1926, to more satisfactorily hold the gear we are also trying friction blocks. This is about our experience today. It has been good but rather expensive to maintain. We have not been able, so far as the sensitiveness of the reverse gear to respond is concerned, to overcome in whole the difficulties which have been experienced. By "the sensitiveness of the reverse gear to respond" is meant when you give an engine a notch, have it take the notch. When you hook an
610 engine up one notch with (T. 2171 to 2180) power reverse gear you do not get the entire benefit of that notch. That is, at times you may have a gear so that it will respond, and again it will not. The common complaint is that there is often required two notches, and it was with that in view that we tried to make the control mechanism more sensitive by changing the seating of the valve and our efforts were not successful. The change in cut-off made for

each notch that the reverse lever moves on manual equipment depends upon the design of the quadrant, the graduation, that is, the pitch of the teeth and as to whether it is a single or double latch. To an extent our standard is a double latch which gives a rather sensitive adjustment. A notch in the corner does not have one-half or one-third the valve as a notch in the center. In notching an engine in the center you get 2½ or 3 percent change in your cut-off of the piston compared with a notch of the same pitch further down giving you possibly less. If you work an engine at 25 percent cut-off, that is, one-fourth of the stroke you cut off your steam and expand your valve and give it another notch you get 28 percent, but if you are working it say 75 percent and give it another notch, you would not get a 3-percent change. Your value decreases as you drop an engine down. The same is true both on power and manual reverse. Taking a power reverse and a manual reverse, notch for notch, both being in first-class condition, it has been my experience in checking the cut-off, plotting cut-off curves in connection with locomotive testing, as a rule, you get a finer adjustment with the manual than you do with the power reverse. I am referring to the Ragonnet type E gear. with short cut-offs, 25 to 30, in that range you get about 5 to 6 percent change for each notch, that is, on the Ragonnet type E reverse. With the manual, especially the double latch arrangements which are in use to a great extent in passenger service your value is less. It is around 3 percent.

611 I have had before me the problem of determining the cause of insufficient lubrication of locomotives equipped with power reverse gears. At the time I came with the St. Louis-San Francisco they were having quite a bit of trouble with the late locomotives. The bull ring was all shot, cylinder packing, valve chamber bushings, and things like that. The locomotives were not giving anything like the expected performance or like what was being obtained from other locomotives. This problem was turned over to me. Tests had been conducted with a view to trying various materials which would step up the operation. Material that was entirely satisfactory elsewhere would go down with a low mileage. We then got in behind it from an operating standpoint and equipped a locomotive with a dog house on it and started out in passenger service. We had 20 locomotives operating in pool service between St. Louis and Oklahoma City and we just went back and forth getting the actual handling of the locomotives by various engineers. I personally made all those trips and a good percentage of my knowledge relative to failure to properly lubricate and its effects on valve parts was gained from those trips. I know that lubrication can get away from a man on a locomotive equipped with a power reverse quicker than it can with one equipped with a manual.

We have more trouble with lubrication on locomotives equipped with power reverse than we do with locomotives equipped with manual reverse. They are our greatest source of trouble.

Valve rings become cut and steam gets down into the cylinder packing with resulting decrease in mileage and there is a wear on the cylinder walls.

If you let your lubrication get away from you it makes no difference whether you have a power reverse or a hand gear.

612 With respect to gears getting away from an engineer—on a power reverse gear engine a man would not catch it until after appreciable dryness occurred, etc., where with a manual gear it would immediately start manifesting itself on a reverse lever latch by rattling of the latch as a rule. This rattle is caused by an increased force; you get an increased pull on the lever when you do not have enough lubrication. I do not think that the rattle on the reverse lever is a proper indicator of the extent to which the engine is being lubricated; but it is an indicator. I do not think that the hand lever should be on there so that it would rattle in case of dry valves. To the question: "* * * You think the hand lever should be left on there merely for the purpose of rattling when they get dry valves?" Witness replied: "I think if a locomotive is within a range, and of a design where a hand lever is satisfactory, there is that advantage in it." With respect to within a range—Take the medium weight pacifics, that is, minimum weight locomotives the valve gears of normal weight, diameters not excessive, and the travel around 6 or 6½ or 7 inches, as a rule, it is our everyday experience that they are handled satisfactorily, whereas, if you go to heavy locomotives, with long lap and long valve travel, larger diameter of valves, heavier parts, I do not think you could handle them as satisfactorily with power reverse as with the manual reverse, and it is questionable as to whether you could even make the application with the design of your boiler or cab. As a rule boilers on late power, on the back end, are pretty close to the width of the cab. We make the boilers that way. To narrow the boilers in order to put on hand gear it will be necessary to make a sacrifice in the capacity of the locomotive.

We have 33 locomotives awaiting disposition this year and 164 have been retired in the past five years, or 33 percent.

613 These have been our light saturated locomotives, the majority of them being 8 and 10 wheelers ranging from 100,000 to 135,000 pounds on drivers—locomotives built in the 90's on up to the early 1900's (T. 2180–2190).

614 I do not say which power is to be retired, or make recommendations with reference thereto. I make recommendations regarding motive power to be purchased and give an opinion regarding the assignment of locomotives. As to the actual retiring, that is a matter of charging off, depending upon the valuation and how much money is available. There are various phases with respect to retiring a locomotive. At the present time it is a matter of getting a light locomotive, that is, a saturated type, out of service. When it comes to a consideration of present operating conditions, especially

main line service, the progress that has been made within the last five years in motive power, just from a standpoint of economy of operation, will force attention more to locomotives in main line service than has been given heretofore. And where it has been a matter of getting rid of this obsolete power, as a rule, that is pretty well taken care of. We still have something like 125 to 150 saturated locomotives in branch line service, and they will no doubt be the first to go. It is going to be a matter of stepping-down locomotives now in main line service to possibly local service, and replacing them with strictly modern power if possible. We have found from experience that our 1930 engines give us about 25 to 30 percent better operation, both from a fuel consumption standpoint, ton-mile hour, and output, than locomotives of similar weight placed in service six or seven years previously. This is principally due to higher steam pressure—of the type E superheater which gives us a considerable increase in boiler capacity for a given diameter shell. They have better proportioned boilers and furnaces, and a limited cut-off which permits a man to get a much higher horsepower capacity within a given limit.

The motor train mileage for 1922 was 229,702, whereas in 1930
it was 1,177,939. As a rule motor cars have been confined
615 to branch line service, with the result that the locomotives
which have been used in that service have been taken away or have been scrapped. I would not say that happened in all instances, but as a rule that is done. With respect to branch line service and the substitution of motor cars for steam cars, there has been a constant increase in the motor train miles, that is, from 1922 to 1930, and the increased thermal efficiency of a motor car in comparison with a steam locomotive justifies the substitution. We expect a further decrease in locomotive mileage and an increase in motor train mileage. We have something like 2,500 miles of what I term branch line, and upon it there are any number of steam trains still in operation.

I have been here regularly during these hearings on the power reverse gear, and I have heard some of the testimony about creeping, and which was not new information to me. I have been familiar with the trouble resulting from creeping for years.

As mechanical and test engineer, I have direct charge of the engineering under the supervision of the chief mechanical engineer, and I worked out the proportions of the locomotive power we built in 1930 with the chief of locomotive power and the chief mechanical engineer. So far as the proportions of lubricators to be used were concerned, I worked them out (T. 2191–2197).

J. L. RYAN, on cross-examination, testified:

As engineer of tests it is my duty to make service tests and report on comparative efficiency, etc., of various specialties. As to just what is to be used, the chief of motive power makes the decision. In other words, I am sent out to find out the facts and report on them.

With respect to the 11 failures in 1930, the first one referred to was a broken radius rod, and that was on a manually
616 reversed locomotive. The second was a lost pin out of the eccentric, and that was on a manually reversed locomotive. The next one was a bridle-rod failure, and that was on a manually reversed engine. The next one was a broken tumbling shaft, and that was on a power-reversed engine; I would not say that the power reverse gear was responsible for it. All of my testimony is to the effect that that happened on an engine which was equipped with power reverse gear. It might have happened just as well on one equipped with manual reverse gear. The tumbling shaft is not any part of the power reverse gear mechanism but is part of the valve gear. The object in tabulating this was to get parts all the way from the reverse lever clear forward that would have any connection whatever, or any effect whatever, on the reverse gear should they fail. In the instance referred to, this tumbling shaft failed in the box and merely made the gear inoperative. The failure was in the center of the bearing. It did not let the bearing down but just broke the connection. The shaft failed and the operation of the arm had no effect so far as shifting the gear was concerned. Manual and power reverse are the same in that respect. I cannot give any one of the failures referred to as being due to the power reverse mechanism. Only in one instance was the part that failed a part of the power reversing apparatus, and that was the failure in 1929 on locomotive no. 1508, where the power reverse became inoperative, resulting in a delay of 1 hour and 10 minutes. In 1930 there was a single failure which was a part of the power reverse mechanism. In that year two of the failures were parts of the manual reversing mechanism—locomotive no. 1027, reverse lever latch bridle rod broke; and no. 1020, reverse lever latch broke. This gives a failure of the reverse lever during 1930 to every 7,000,000 locomotive miles, but none of them was on power reverse in so far as the cylinder itself was concerned.

617 The lightest class engine equipped with power reverse is United States Railroad Administration six-wheel switchers, weight on drivers 163,500 pounds. The lightest class of road engine we have equipped with power reverse is a group of Russian locomotives; they came equipped with power reverse and weigh 185,000 pounds. The next highest class of road engine equipped with power reverse is a group of heavy Pacifics weighing 190,000 pounds on drivers, and the next is United States Railroad Administration light Mikados. I had nothing to do with the acquisition of these 190,000-pound locomotives. Since I have been with the Frisco all engines purchased have been equipped with power reverse, the lightest of these being the Mountain type locomotive weighing 233,700 pounds on drivers.

I functioned as chief inspector during the construction of our 1930 order of locomotives, and prior to that, when with the Northern Pacific, I inspected or acted as inspector on several orders. I have

not, to any appreciable extent, had occasion to examine specifications of Frisco engines that were being constructed or purchased prior to 1930. I have never seen the specifications of such engines under construction, or to be constructed, which were not equipped with power reverse, on the Frisco. The only specifications I am familiar with of the Frisco, are those covering our 1930 locomotives. Previous locomotives built, or the only locomotives built while I was with the Frisco, was early in 1926, and the specifications were written and the orders let the latter part of 1925. I have never recommended that engines equipped with power reverse have that type of mechanism taken off and manual reverse substituted (T. 2197–2206).

618 A. OLSEN, locomotive engineer on the Chicago and North Western Railway, residing at Chicago, Ill., testified:

I was promoted to run an engine on May 5, 1907, having been a fireman since February 9, 1903. From the time I was promoted, I ran engines continuously to 1908, and off and on until 1915; and with the exception of a few months I have continuously been running engines since 1915. I have operated them over the entire Wisconsin division and part of the Madison division. I have operated in through passenger, suburban, and freight services, using all classes of engines except the H, L, and J–4 types.

I am at present operating an engine equipped with hand lever. I have experience with power reverse levers, which started about 1918. Prior to that date all my experience had been with hand levers.

I have never been injured by a hand lever or while using one, nor have I ever seen anyone else injured.

I have had the job of breaking in engines out of the back shop. On that job we had what was called a dead track, about five or six miles long, upon which we ran the engines back and forth and worked them for a period of eight hours. But if an engine was exceedingly stiff it would probably be run the next day for a few hours. I had this breaking-in job from time to time. From the time I was first promoted, and while on the extra board, I used to catch those jobs, providing there was no regular breaking-in man available. I caught these jobs over a period extending up to about two years ago. With respect to my ability to handle the hand lever on these engines being broken in—well, I would sometimes find them where the link block would be fitting snug. They would then be properly lubricated and run up and down the track, reversing the lever, getting all parts properly lubricated. As a rule, inside of eight hours they were
619 generally fairly well broken in. My duties in breaking in an engine were not exclusively confined to breaking in the hand lever. It applied to all parts of the locomotive. It was my duty to look after the bearings and see that they were properly broken in, as well as the hand levers. On those jobs I do not recall having had help to work the hand lever, nor do I remember any occasion where I was unable to throw the lever myself. On those breaking-in jobs we had no one on the locomotives other than the engineer and fire-

man. Aside from those breaking-in jobs, I have never had any trouble in handling the hand lever or in adjusting the valve gear of the locomotive by means of it. I have always been able to maintain a fixed point of cut-off with the hand lever. On one occasion I had the experience of the hand lever becoming unlatched of itself and going to the corner. That was on what was known as the head-end job at Blodgett. We were facing east and had to go up to the top end to get a car. I did not notice that the water was a little high. We only had four or five minutes to get there ahead of 209, so I probably opened the throttle a little too wide and started working water a little. She jumped two or three notches out of the quadrant, but as soon as I eased off on her she went right along. When I say "she jumped two or three notches", I mean she was only two or three notches from the center; she jumped toward the forward corner, and the jump was only a distance of two or three notches. Aside from that experience, I have never had any other occasion where the lever became unlatched by itself. I never had any experience with the lever pulling away from me after I had unlatched it.

I have handled the power reverse ever since it has been here. I could not tell you exactly the amount of time I handle the power reverse or the amount of time I handle the manual reverse. To
620 the question, "How long have you had the hand-lever job you have got now?" the witness replied, "This is an air reverse now." I have had my present run off and on for three years and have had exclusively power reverse gear engines on that run. Prior to this run I could not say the amount of time I operated engines equipped with power reverse, because I was on the extra board. But when they came here in 1918, I handled them exclusively from then on. However, I may have had one or two hand-thrown small-type engines on a work train. I am talking about road service, and exclusively about the breaking-in job.

In road service on engines 2541 and 2542 I had great difficulty in preventing the engines from creeping, and it seemed they would creep regardless of where we put the lever. They were reported time and time again. Even the Barco people came here and looked them over. They would probably get them fixed up for a while, and then they would creep again. That experience was during the years 1929 and 1930. I have not had those engines recently. They were both of the J type. On my present run we have 2499 and 2597, which are J type engines. No. 2499 was creeping a little about three weeks ago. It was reported, but up to the last trip she seemed to be working fairly well. The other engine has not been creeping. On this engine, 2597, I had the stud which connects the reach rod to the bottom end of the reverse lever, the nut and the cotter pin were chewed off and both nuts, the spring nut and the other nut, both came off going down Eden Hill, and the engine reversed itself. That occurred on the morning of May 26 of this year. Before this happened, I was going between 40 and 45 miles an hour. I applied the brake in order to get the speed of the engine down to the speed limit

set for that hill. When I got the train down to about 25 miles an hour, I released the brake, and as the brake released, the pin came out, and she released herself. The (T.2206–2216) engine skidded—she was in back motion, going ahead. When the
621 valve went into back motion, it had a tendency to hold the drivers back. I yanked her wide open and got the drivers spinning. At the time this happened we had the firebox door unlatched, and the fire shot out on the floor. It would have burned the fireman if he had been standing there. The effect on the train was that the slack ran in and there was a severe jolt at the hind end. Afterwards I inspected the engine and found flat spots about the size of a dime, which I reported, but nothing was done that I know of. I also found a broken bull ring on the right side. The time this happened I did not stop the train. After I got the wheels going I grabbed the reach rod and held it up and got her flush with the holes in the bottom of the reverse lever, where she is connected, and slipped the stud in, got a bite in her and away she went down in the corner.

On May 30, 1931, with engine no. 2362, when we arrived at Fond du Lac, I reported the feed valve. A new one was put in, and apparently everything was O.K. It was the air-feed valve that controls the pressure to the train line. As I got coupled up to the train, I was going through Fond du Lac proper, and it seemed that the air was going up beyond all control, so I throttled and got along the best I could to Clymen Junction; and while taking water at that point, I turned the cut-out cock behind the main drum, and took the feed valve apart and put a little oil on it—she was pretty dry—and put it together. When I started to turn the angle cock again behind the main drum I had my hand on the air reverse and I reached up—I was standing on the side rod and reached up to turn the angle cock, and as I opened her up she started shimmying and caught my hand here [indicating] and knocked me off my balance, off the rod, but I was not injured. When I turned the cut-off cock this power reverse mechanism shimmied back and forth, the cross head
622 went with it. When I say "shimmied back and forth" I mean it moved back and forth, that is, the cross head. The reason I stood on the side rod was because it was handy, and I had to reach, there being no ladder, to get up to the angle cock. I believe that engine was equipped with a Ragonett power reverse. I think engine 2597 was equipped with an Alco. Neither of these accidents would have occurred with a hand lever—I never had anything of that kind happen with a hand lever. The bull ring did not break first. What happened was that the bolt which connects the reach rod to the bottom end of the reverse lever fell off right on the deck at my feet. The nut had worked off, and that was before the bull ring broke. With respect to the cotter pin I referred to, I know it was in there because I tightened up on that nut and the spring nut at Proviso before I left, and I know there was a cotter key in there, because

I took particular note of it. We had an engine failure like that a year or so before and I have always watched closely since. As to how the nuts go off, they must have been partly worked off before, and in the dark I did not notice it.

At Mayfair in January 1928, on engine 2542, the weather being pretty cold, I had instructions from the train dispatcher to reach Mayfair not later than 6:30, due to the fact that there were so many suburban trains there. I made it, but there were one or two of the trains a little tardy and I was held up. When I stopped, the train was stretched out, and when I got the signal I was unable to move the train, unable to move the lever, on account of what defect I do not know, but I reached over and grabbed hold of the steam cock, turned her over and got the slack and she went ahead. I believe that engine was equipped with the Barco type of gear. On that engine the
623 auxiliary steam valve was located right up alongside the boiler head on the side of the boiler.

When I was in the pool I would generally find nine out of ten power reverse gear engines creeping, especially in gravel service, and that did not necessarily apply to any one make of gear. The Barco, Ragonett, and Alco types of gear were being used. With creeping gears, all I could do was to oil them, look after the packing and if that did not remedy it, I would have to report it. And I always reported them when creeping. If I should happen to get the engine again I would probably find her in good condition. As to how long the engine would remain in that condition, I could not tell you, owing to the fact that probably I would only have the engine once in two or three weeks. I have had regularly engines nos. 2541 and 2542, and I had a great deal of trouble with them creeping; even after they had been worked upon, they would only operate a few days, or a few trips, when they would start creeping again. In addition to creeping, with the power reverse gears, I have observed the valve gear working back and forth. This would not have any effect on the lever. The lever would stay where it was. Especially on the Baker valve fear, you could see the valve motion working back and forth. As to whether it was the valve gear or the reverse gear, I could not say. It must have been the piston or otherwise the valve gear would not move. You could see the valve gear moving back and forth—that was a Baker gear. I could not see the cross head of the power reverse gear as that is underneath. You could not see it unless you got down on the step and I never did. I do not think I could have seen it if I had, because the cylinder is ahead of it. This particular application has the crosshead of the
624 power reverse at the front of the locomotive. I have never seen them applied in the opposite direction, that is, with the cross head in the rear. In addition to creeping and the valve moving, I had another experience a few months ago with engine 2338. When I got her at Fond du Lac, I closed all the drain cocks before I started the pump. I got about 20 pounds of air and started to back out with the reverse lever in the rear motion, in the back corner,

and she wanted to go ahead but I stopped her immediately. I had that happen on other occasions while in the pool, and that was at 40th Street roundhouse. To stop the engine I applied the independent brake. I had enough air to do that as I had just started to move, and there was sufficient air to move or cause the power reverse gear to move the valve gear into the position that was indicated by the operating lever. After I stopped she threw herself over because she then had sufficient air, that is, she came over by herself without my moving the lever. The pump was working. I had just cracked the pump throttle. If the air had not been pumped up sufficiently to raise the reversing gear I do not think I would have been able to have stopped. I would not have had any means of stopping her outside of the 20 or 25 pounds of air that I had. I do not make it a practice to open the throttle without having the air pumped up. But on this occasion owing to the fact that there was so much gas around the roundhouse, I wanted to get out. We were all gagging and coughing. If the locomotive had been equipped with the hand lever, it would not have been possible to move in the opposite direction from where the lever was thrown.

I have never used the hand lever for braking purposes. I have never had occasion arise where I have had to use it for that purpose.

With respect to the efficiency of a locomotive equipped with
625 the power reverse, I find that the hand lever will stay where you put it, and the air reverse, as a rule, creeps if it is not in good shape, and you can not tell how long it is going to be in good shape. From the standpoint of economy and efficiency of operation, it means that I am ashamed to look at the fireman, and another thing is that I can not handle the train properly and get over the road the way I should. I have never had such difficulties with hand levers. I never had any trouble with regard to hand levers. From the standpoint of safety, I can not see where there is any difference between the two levers. I have never experienced any danger with the operation of the hand lever (T. 2216–2228).

A. Olsen, on cross-examination, testified:

Since I have been operating engines equipped with power reverse, I have had them in freight and passenger service, including suburban passenger service. In the absence of an accident we generally make the passenger runs on time. In freight service we have time freights and generally make delivery of goods on schedule. On the engines I have used with power reverse, the power reverse itself has not interfered with my scheduled time. I, of course, have not been able to perform all my assignments on schedule. As I said before, with engines 2541 and 2542 I could not tell what time they were going to make when they were creeping. That was on runs 295 and 296, Chicago to Fond du Lac. All the time that they were on that run I had this trouble and it covered a period of about two years, or possibly better, and until those engines were taken off the run. That was a time freight run. I do not say that I was late regularly on

that run, but I do say off and on. As to how often I was late I could not say. It might be two or three times in a month. Information would be wanted as to the reason for the poor run. I always claimed it was due to something else, because I have learned to leave
626 the engine out. While my road does not tell me, I just leave the engine out of it. To the question, "Does not your road tell you to report any trouble that you have with your engine?" the witness replied, "There have been times when it was, and times when it was not. Them engines have been reported."

I always reported the engine when it was creeping. As to the number of times that I did that, I do not know. But it happened over a period of two years, off and on. That was 1929 and 1930. I had a creeping engine only during one month in 1930 and during that month reported it. I could not tell how many times, probably two or three. We even had the Barco man come and look them over. The last time I made a run on one of those engines was in the winter of 1929, but I have no idea how many times I reported it during that time. I reported it off and on whenever I had trouble with them; they would fix them and I would go along for a while and they would go bad, and I would report them again. That is the way it went. There were three engineers who had the same trouble. One of them was Hay, and the other was Summers. Outside of these two Barco equipped engines, I had no trouble maintaining my schedule on trains equipped with power reverse.

On the occasion when the stud worked out of the reach rod, I did not touch the nut, but just slipped the stud in and got a bite on it so that I could throw the lever over. When I got her down to the forward corner I shoved the stud back in there. I was able to make this repair without the lever injuring me in any way. My opinion is that the valve gear would go in the forward position if I had had a manually operated lever and the reach rod had come loose from the lever. If I had had a manually operated lever, I probably would have had to do the same thing as I did with this power re-
verse lever, go along and reduce the speed of the train, drift
627 down hill into Fond du Lac, and then if I could, get hold of something to take us to our destination. I do not think that I would be able to attach a reach rod to the lever on a manually operated gear when the engine was in motion, because it is underneath and I would have to stop to get hold of it. I do not recall that we have any manually equipped engines where the reach rod comes above the floor of the running-board. If the reach rod should become disconnected from the lever, the engine would go into forward motion because of the point of cut-off. It would not be so much the pull from the valves, but is the way the valve gear is tilted toward the forward end when you have her hooked up to the proper cut-off. I do not know what the pull would be on the reach rod which comes from the weight or the tilting of the valve gear. Of course, there might be a little exertion there. It would go forward as that is the natural position of it if the reach rod becomes discon-

nected. So far as I know there is not at all times a pull on the lever when the reach rod is connected to it. I have never had that happen to me and could not go into detail about it. The reason there is a latch that fits into the notches on the quadrant is simply to hold the lever in position so that you can work your engine properly. I could not sit there and hold that lever all day with the throttle open. If it did not have any notches or any dog, the lever would not stay in position, and the same is true of the air reverse; neither one would. That is what the notches are for. I do not find any pull to any great extent.

A. OLSEN, on redirect examination, testified:

On that occasion when engine 2597 reversed herself, when the stud came out, the engine would not have reversed itself if it had been equipped with a hand lever (T. 2228–2236).

628 W. B. SUMMERS, locomotive engineer for the Chicago and North Western Railway, residing at Chicago, Ill., age 50 years, testified:

I operate on the Wisconsin division in the same general territory as that of Mr. Olsen, who immediately preceded me, and have held the time freight job that he told about. I have held it off and on at different times for the last eight or nine years. I have worked as a locomotive engineer for the Chicago and North Western off and on since 1907. (For the purposes of the record it was developed that Mr. Olsen was 51 years old.) I have operated all classes of engines except the H's and the J–4's in both freight and passenger service, suburban freight and suburban passenger. Prior to 1918 my work was almost entirely with engines equipped with hand levers and since that time my experience has been with locomotives equipped with hand levers and power reverse gears. Since 1918 about two-thirds of the time I have operated locomotives equipped with power reverse gears. I never have to exert myself in handling hand levers. I have had the job of breaking in engines, having caught that job when I was working in the pool, and on that job I was always able to handle the lever without assistance. I never had anyone on the engine with me during those breaking-in jobs, except the fireman. I never had any experience with the hand lever becoming unlatched in the quadrant of itself and going down to the corner.

On one occasion I got my fingers pinched with the hand lever. That was on the milk train going to Gainesville. I was going along at about 40 miles an hour and was just over a hill—it was 20 years ago—my experience in running was not very great at that time. I reached over and got hold of the lever to hook her up with one hand like that [indicating], and she gave a little bob down
629 like that [indicating], and there was no stop lug on the quadrant, and the reverse lever hit the boiler head and pinched my fingers there. I lost a nail off one of my fingers. That was all. I reported the absence of that stop lug and it was afterwards put on.

I do not think that I lost any time on acount of that accident—it has been so long ago. Aside from that occasion I have never been injured in any way in connection with the hand lever; neither have I had any occasion, other than the one cited, when the hand lever got away from me.

As to maintaining a fixed point of cut-off with an engine equipped with power reverse, well, they creep and do not hold the valve at the proper cut-off, and that has occurred in different periods to the extent of about two-thirds of them. I had experience with engines 2541 and 2542, which were on this time freight run Mr. Olsen was speaking of. They were on that job when I got off of it last fall, but have since been taken off. At that time I think Mr. Olsen was running on that job opposite to me. We were always changing around, and there were three different engineers running these two engines on these different jobs. I think Mr. Olsen was there part of the time when I was (T. 2236–2241). I had a lot of trouble with those two engines creeping. They did not respond to the movement of the reverse levers and would not move the valves in response to them. By saying that they did not respond to the movement of the lever, I mean that if you wanted to move it one notch, you would have to put it down two, three, four or five, maybe, before it would move the valve. Then the engine would grab a lot more than you intended. The sudden jerk would tear the fire and it was hard on the pins, bushings, and driving blocks. When you hook them back up sometimes they come back too far.

A difficulty I had with no. 295 was on April 1, 1930, about 3 o'clock a.m. I had a meet order with no. 102 at Campbellsport. I
630 was going along about 40 miles an hour, and the nuts came off the bottom end of the reversing lever and the pin came out, so that the engine jumped into the back motion. The fire shot out into the cab around the tell-tale holes. I looked out and the wheels were sliding. The engine had reversed herself and jumped into the back motion. For a minute I did not know what had happened to the engine. I set the brakes and came to a stop. The operating lever of the power reverse was standing in the position that it was when the bolt dropped out. I did not observe that the bolt had dropped out before I stopped the train. When I stopped I got down and looked at the valve gear and traced it up to the cab and saw that the engine was in the reverse motion and that a pin was out of the reach rod. That pin was lying on the deck. When in place the pin was a connection between the reach rod and the lower end of the reversing lever, that is, the reach rod connecting the lower end of the lever with the air valve. I inspected the engine and found I had flat spots seven or eight inches long on the drivers. When I started to pull out I found I had some rings broken in the valves. I do not think there was anything wrong with the cylinders but I had a broken valve ring on one side. It was necessary to remove the tires on the drivers. Where the accident occurred was

about a mile from the telephone located at Kewaskum. I pulled up slowly to Kewaskum on account of the flat spots, being afraid I might break the rails, and called the dispatcher. I was delayed about three or four hours, and I think a passenger train was delayed an hour.

I had engine 2911 on the 29th of last month. That engine is equipped with a power reverse gear of the Barco type and is a class E–2 engine. On that date I was in the second section of train no. 511, a through passenger train, Chicago to Duluth. I had 16 cars,
and the air reverse crept all the way to Elroy, the result being
631 I burned a lot of coal and lost time. It also had an effect upon
the movement of the train. When I got up on the hills around Devil's Lake, the engine was hardly able to handle the train because of the creeping, with the short cut-off. I think I lost 25 minutes on account of the air reverse lever coming up with a short cut-off. The engine would work hard, and it would jerk the train; and when she would creep back up, the train would slow up. The effect upon the slack of the train was that it kept it out because the train would slow up, come to a closer cut-off with the reverse gear creeping up near the center.

If the air reverse was perfect, that is, you could keep it with a cut-off where it did not creep, I do not say that there would be any difference in the efficiency between a locomotive equipped with power reverse and one equipped with hand reverse. But where you have creeping there is a difference. The hand lever will maintain or keep your valves at the same cut-off, where you want to work the engine. Where the reverse creeps more coal is used and the efficiency of the engine is not as great.

There are a couple of other occasions where I was delayed on account of the power reverse gear. Once I remember the cap over the gear bar came off. There were some studs there which broke off. The result was that the gear bar would work up, and if I would try to hook the engine up, it jerked out. But if I left her down and worked slow in the corner, I could get along with the train. It would stay down in that place, but if I tried to hook the engine up it would start jumping up. Upon that occasion we had to be at Mayfair at 5:40 in the morning and get across the interlocking plants there or stay at Northfield until 10 o'clock in the morning. The result was that I stayed at Northfield. The reason I was held up
was because I had to run slowly on acount of the studs break-
632 ing. The train I was operating was a freight, and we had to
get to Mayfair before the suburban trains started, and the latest we could get there was 5:40. I do not recall any other occasion where I was delayed on account of anything in connection with the power reverse gear. I had these studs break once before when I was on the road, but I was not very far from the terminal at Milwaukee and there was no delay.

I really believe the hand lever is the safest (T. 2241–2250).

633 June 17, 1931

W. B. SUMMERS, on cross-examination, testified:

Since the war I have been working in freight, passenger, and suburban service. Two-thirds of the time was in freight service and one-third in passenger service. A little better than two-thirds of the locomotives I have operated in those two services were equipped with power reverse. Unless I have a failure or something happens I generally reach Northfield on time with time freight no. 296, Fond du Lac to Chicago. On this run I remember having only two delays, the one at the time the tire slipped and the other when the air reverse broke. On the 23rd of last month I had a delay in passenger service due to creeping of the power reverse. The delay amounted to about 25 minutes. The power reverse was a Barco. That is the only case I can recall where I had a delay in passenger service on account of power reverse. I have had more delays than these three but they were small ones about which nothing was said and which I was able to cover up by making up the time. With respect to breaking in of engines I have had 4 or 5 days work of 8 hours each. When I say that the power reverse on two-thirds of the engines was creeping I mean two-thirds of the engines which I have used were power reverse but I did not have what would be called a failure. Where I had a failure it was necessary to make out a report. I do not mean that every time I got one of those engines it would creep. I say that on two-thirds of the engines equipped with power reverse there is creeping. I do not mean that two-thirds of the engines equipped with power reverse creep every trip. An engine would be repaired and I probably would not get hold of it for a month or two. I could not say for sure how many of the engines creep but I imagine it is about two-thirds. In the 10

634 years I have run engines with power reverse I roughly estimate that somewhere around two-thirds of them creep. Suppose I made 600 trips during my experience with power-reverse engine, then on 400 of those trips the power reverse has crept or some other defect has shown up like jumping. I have reported in writing the creeping a number of times. To the best of my knowledge I think I have reported creeping every time it occurred. I do not say I reported 400 times out of the 600 as a number of times the reverse creeps but it is not bad enough to make me lose time or anything of that kind. Of course it is understood that these 400 trips is a meaningless figure used only for the purpose of illustration.

Creeping of the power reverse has not been overcome. We still have that difficulty. That condition is neither better nor worse than it was five years ago. In April of this year I made 10 trips on through freight runs but I don't know how many times I reported creeping, although I did report it to the master mechanic and frequently to the roundhouse foreman, and I think reports were made on the daily work reports. I could not say how many times I filed

a daily work report on the power reverse, but I reported it lots of times. A report was made more than once, but I do not remember how many times. It might have been that the reverse in that month was fixed. The last time I had a through freight run regularly was, I think, last fall—I do not know just when it was. I did not have it in December, and I think it was before November that I was bumped off the job. I do not think I was on a freight run during January, February, and March of this year. I cannot say how many trips I made during September and October of last fall, as I might have been laying off. While I had the run regular last fall, around last fall sometime, I might have laid off some trips. I could
635 not say how many trips I made. I could not give an estimate of how many trips. To the question, "Give me a time when you worked", witness replied, "Well, I do not know, I would not say when I got bumped off it. Mr. Olsen bumped me off there last fall." I think I made 30 trips altogether last fall, but out of those 30 trips I could not say how many times I filed a work report on power reverse. I would not say that I filed a work report on 20 cases out of the 30 times I had the run last fall, because I do not remember whether the power reverse crept at that time or not. Probably some of the time it did. I know I had quite a bit of trouble then. I do not know how many times I reported it. I know I have reported it (T. 2251–2262).

With respect to the occurrence I related where the engine went into back motion it was equipped with a Barco power reverse. When the engine went into back motion the pin came out of the lower end of the reversing lever from the reach rod. I was running at about 40 or 45 miles an hour when the engine jumped into back motion. The wheels skidded. When she first jumped into back motion there was a shot of fire which came out into the cab through the tell-tail holes, as well as smoke, and the engine skidded, causing flat spots on the drivers 6, 7, or 8 inches long. I did not measure them, but just estimated the length. I could not say just how far the engine slid. I have no idea how thick the flat was at the highest spot. I know there were long spots which I judge were about 7 or 8 inches or something like that. I know nothing of the mechanism of a Barco power reverse—nothing about the way they are made. I know something about the way they work, nothing about how they are built. I never studied them.

636 They are operated by air which I know goes through a valve, that I know. The valve is controlled by the lever in the engine. I do not know what the air does when it goes through valve. I never passed any examination on that. After the air passes the valve it goes into a cylinder. As to what happens in that cylinder I do not know. I know there is an exhaust to the valve, the cylinder is there, but I do not know what happens to it. I know that I can operate the mechanism other than by the hand valve and that is by the steam valve, you can cut the steam in, after cutting the steam

in its works the same as with the air. There is another way you can work it besides the steam and air, that is with a monkey wrench on the nut down below and by that means you can reverse it if the air and steam are cut off. That is done by a work screw, a kind of worm I think that goes up through to something. I do not know anything about the ports and the operation of it, but I know there is a worm screw which goes up there in connection with the air reverse and if that breaks down you can take the cap off and turn it over. There must be a piston inside the air cylinder as it could not work any other way that I know of. When the piston works I do not know what happens to affect this worm and worm wheel. The air must have some effect on the piston but I don't know what it is. I do know the air must work the piston or they would not have it there. The air must move the piston and when it moves the piston it must move the rest of the machinery as it is coupled up with it. I do not think there is a piston rod in the piston out of the air cylinder and I do not know how the movement of the piston is transmitted to the worm (T. 2262–2267).

637 On the occasion when the engine jumped into reverse, I do not know whether the piston moved. I do not know whether or not the air valve moved when the rod dropped. After I stopped the engine I got down on the ground and looked around and saw the engine was in reverse motion, and I started tracing it up. I knew it was in reverse motion because the valve gear was in the back motion, and after tracing the cause of the trouble back to the cab, I found the bolt, which I put back in place. I accomplished that by getting hold of the rod and having the fireman take the lever and hold it while I put the bolt in. I do not remember in what position the fireman held the lever when I put the bolt in. It was in rear motion and in order to get the bolt in I had to put the lever in reverse motion. After getting the bolt in, the only difficulty I had was with the flat spots on the engine. I had no further difficulty in operating the reverse mechanism. To the question, "When did you first notice that the creeping valve would use more coal on the locomotive?" the witness answered, "When did I first notice it? When I was using it." In 147 miles I would use two or three more tons of coal, at least two tons more, with the power reverse creeping. This means that on two-thirds of my trips I use two or three tons more coal, generally by reason of a creeping valve, than I would if the reverse mechanism was in proper order.

638 W. B. SUMMERS, on redirect examination, testified:

You cannot reverse the engine with the Barco power reverse gear by using a monkey wrench when the engine is moving, because you would have to get down on the ground to do it. You can reach the point of the power reverse gear cylinder with the wrench while standing on the ground but it would be over your head. It would be hard to reach. If the track was low along

639 the side, it would be pretty hard to reach. I have never had occasion to do it. It is necessary to remove a cap in order to get to the part which you move with the wrench. With respect to my previous remark that I did not know "it had a piston," I was referring to the Barco air reverse—the piston rod was what I was referring to. I meant it did not have a piston rod. It has a piston. My observation is that it has some kind of a valve there as a connection between the reverse gear itself and the valve gear, but I do not know just what. Between the reversing gear cylinder and the parts in front of it, the valve gear parts, there is a rod called a reach rod and which runs to the valve gear. The parts of the air reverse mechanism, the working parts, that permit the air to enter and escape from the cylinder, are not exposed to view so that they can be seen. I have never taken down a Barco air reverse or seen it taken down, and it is for that reason that I am unable to tell just what the internal parts are (T. 2267–2273).

W. B. SUMMERS, on recross examination, testified:

The hand reverse is safer than the power reverse in that if anything connected with the power reverse jumps into back motion, it would be more dangerous. It is dangerous in that it is liable to double the train up and hurt someone in the caboose. If the fireman was firing, fire would rush out of the door and would be liable to burn him in the face. I do not say that if something broke on the manual reverse there would a dangerous condition, because they always go in the direction in which you are going. I do not know whether, if the reach rod were to break and drop down on the driving rod, it would be dangerous, as I have never seen that happen—if it was going in the forward direction it would not be as dangerous as in the reverse direction—however, there may be danger in that.

640 It is dangerous to throw an engine into back motion when it is going ahead. I have heard witnesses in this case testify about using the manual bar for a brake, and as to whether that is a dangerous thing to do depends on the speed. At slow speed it isn't dangerous, as in switching. I would not say that it would be dangerous at five miles an hour. I do not think that it would be dangerous at 10 miles an hour, but it would be more dangerous as the speed increases. I would not reverse an engine going any faster than 10 miles an hour, because it is my opinion that the cylinder heads might be knocked out. I have never known that to happen—I never had it occur to me. Another thing that might happen is that rings in the valve would break but I have never known that to happen at 15 miles an hour. If it did happen it would damage the engine. It certainly would be dangerous to do that if you were pulling a train.

I was running about 45 miles an hour when the engine went into reverse, and it did not knock out the cylinder head nor break any rings, nor hurt anyone, but the brakeman and the conductor who were in the caboose were knocked down. An emergency application

of the brakes, however, would be liable to do the same thing, and that has happened. I think that the power reverse is dangerous because when traveling at a high rate of speed and it becomes disconnected in any way, the engine jumps into back motion. Furthermore, one is more apt to get hurt working around it as a result of the fireman moving the lever when the engineer is not around. In that way a person may be caught in it. However, there would be the same danger with respect to a person getting caught if a fireman were to move a hand lever. It is also dangerous because if anyone were to cut the power reverse out and a man working around the engine did not know it, it is liable to start in either direction.

641 By that I mean the power reverse may move the valve gear while a man is working on something around it. And that could happen on any power reverse gear. To the question, "Is your company still equipping engines with power reverse or acquiring engines with power reverse on your district?" the witness replied, "All of them that I know of have. All of the engines which I have run have all been equipped with them. It is my opinion that we are being furnished with engines that have an uneconomical and unsafe device on them" (T. 2273–2279).

W. B. SUMMERS, on redirect examination, testified:

In the case of an emergency application of the air on a train, the brakes would all go into emergency suddenly and that would be all the way down the train. In case of the air reverse throwing the engine into reverse, that does not have any effect with respect to the brakes on the train. The result of the slack on the train in such a case is to run it in on the engine—the engine backs up on the slack. To the question, "To your mind does that produce any difference as to the amount of shock or strain that is thrown on the train in the two cases?" the witness replied, "Yes." The slack running in on the engine would be greater when the engine jumps into back motion or is reversed (T. 2279–2280).

642 S. RASMUSSEN, locomotive engineer on the Chicago & North Western Railway, residing at Green Bay, Wis., age 53 years, testified:

I had been employed by the Chicago & North Western as an engineer for about 27 years. I worked as a fireman four years prior to the 27-year period. For the last 31 years I had been continuously in the service of the Chicago & North Western operating on the Lake Shore division out of Green Bay and Kewaskum, Wis. I have operated in all classes of service and practically all kinds of power used by the Northwestern except the class H's, E–2's, J–4's, and the M–4 switch engines. For 11 months in 1929 and 1930 I handled power reverse gear on the time freights and since that time have had power reverse for six months on switch engines. Before I took the time freights I was on the lead job at Green Bay for about one year with power reverse. A lead job is a switching job in the yard with a

class Z engine. Before that I used the old type Meline reverse which has been discontinued. These cases cover all my experience with the power reverse gear. Outside of these periods mentioned my service has been with the hand lever. We do not have any screw-type gears on that division.

In handling hand lever my experience has been that so far as the physical effort is concerned, I find that when I am running my own engine I can do most anything I care to, that is because I figure more on the levers of my own engine than on someone else's. I have had engines that I could not reverse by hand without assistance. In those cases I did not ask for assistance, the fireman just came over and helped me to save time, and aside from that I have never had any experience with an engine where I had to have assistance in throwing it over. I do not recall any occasion in handling a hand lever which caused any undue strain on me. On two occasions
643 I have had the hand lever become unlatched itself and jump out of the quadrant with the result that the reverse lever went to the corner. The two occasions were on the same day with the same engine and was caused by the defective latch and that was in the fore part of May of this year. Up to that time I do not recall ever having had a lever jump out. The engine on which it occurred was no. 158 in passenger service and I think she is now awaiting disposal, that is, either to be rebuilt, repaired, or cut up.

I do not recall any occasion of a hand lever getting away from me after I had unlatched it. As a usual thing I most generally feel all the levers before I try to unlatch them, by that I mean I brace myself and try it and if the lever is going to come hard I let it alone, that is all there is to it. I am speaking of about 35 or 40 miles an hour. I feel the lever before I raise the latch. I most generally can get the feel of the lever without raising the latch. I have never been injured in any way or in connection with the operation of a hand lever or seen anyone else so injured (T-2281, 2286).

644 My experience with respect to maintaining a fixed point of cut-off with the power reverse gear has been that with five engineers operating four engines on a time freight between Green Bay and Butler, a distance of 121 miles, and who kept the engines lubricated so that they could be handled, some of them would creep and others would not. The majority would creep and come back where they belonged, then creep again, and come back, due to a defect or some other cause, but which we generally found to be caused by the packing ring. Tightening of the gland would sometimes improve the creeping; but if it did not, then when we brought the engines in, the valves would be ground, which would stop it or change it. After fixing the valve in that way, sometimes it would be quite a while before we had any additional difficulty. This trouble was generally with the 2500's equipped with Barco gears. The engines were all class J. I was on that job with the four engines for approximately 11 months. On December 2, 1926, while preparing engine 1764 for work I was injured by the power reverse gear. The fireman, who

was on the opposite side of the engine, reversed her without any warning while I was oiling. My arm was caught between the radius rod and the guide bar. I did not know the fireman was on the locomotive at the time, nor did he know that I was oiling. At the time I was oiling the forward wedge and shoe, and my right hand just above the wrist was caught between the radius rod and the guide bar. I lost about six days, for which the company settled. The parts between which my hand was caught pass each other at a given point at the rear end. My wrist would not have the effect of keeping them any farther apart. These parts are of steel. The reason my wrist was not severed was because I was too close to the valve cross head. I had no warning of the movement, and I don't know
645 whether the fireman was going to move the engine or not. I don't even recall who he was, offhand. I guess he was going to move her or else the lever was in his way and he was cleaning the seatbox and wanted to move her to get her out of his way. I do not know the circumstances. I did not hear any exhaust from the air cylinder, as there cannot be any until there is a movement. In fact, I heard nothing. If there had been a reverse lever and the fireman had put his whole strength on it suddenly, the result would have been about the same. However, as a usual thing the lever is pulled over slowly. He would have fumbled the reverse latch in order to get it over, and although I could not have heard the latch where I was, he would have moved it about the length of the air lever, as that is about all he could get. A slight movement of the hand lever moves the link block, and in fumbling with the latch it probably would do the same thing—start just a trifle and give you warning enough to get out, or give you warning of the movement. The link block was to the rear of the engine from where I was oiling the forward driver, and close enough so that any warning would be noticeable. This valve stem was going to move, and my arm was between the stem and the bar, and I could have detected whether it was going to move or not. "A slight defect" on the valve stem would tell me to get out of the way. The power reverse gear moves faster than a hand one. I have seen engines standing at terminals where the valve parts would move without anyone operating the reverse lever, that is, when the air would be cut off the compression would leave the motive power, the valve would drop down. I would describe the movement by saying that I generally placed the reverse lever in central position on the ratchet. The weight of the gear drops it down. When it drops down and steam is admitted to the cylinder, the engine would go forward. I have observed in cases of that kind,
646 when the air is again pumped up that the reversing gear stayed where it was, that is, in a forward position and with the operating lever in center position.

Engineers are taught to reverse the engine three or four times before giving or applying steam into the cylinders, for the purpose of finding out whether the reversing gear is operating, and on the occasion I am speaking of, I did not throw her. I always follow

the above procedure with respect to reversing the engines before giving them steam, especially with the power reverse. I have never observed the movement of the valve mechanism while the air was being pumped up. To the question, "What is your opinion, Mr. Rasmussen, as to the comparison between the hand lever and the power reverse lever from the standpoint of safety of operation and safety around the locomotive?" the witness replied, "My opinion would be this, that if you take the same attitude from the one to the other, the safest thing to do is to think before you look, to think before you act. Now, in moving any engine, we are taught to ring this bell preparatory to moving. We are taught to throw the reversing gear regardless of whether it is hand or air reversed, and to see that the parts are properly adjusted and the engine is going to respond when we apply the steam."

The hand gear would be safer because it will stay where it is put (T. 2286–2295).

HENRY E. BLOWERS, locomotive engineer for the Chicago and North Western Railway Company, residing at Mason City, Iowa, age 63 testified:

I have been employed by the Chicago and North Western Railway Company for 49 years and have been running a locomotive for them since 1891, in freight and passenger service. Generally speaking, I have operated engines classed as R–1 and from class Z to
647 class D. In years past I have also operated the smaller engines such as class A and class C. At present I am on a passenger run, using a class D engine, between Mason City and Belle Plaine, Iowa, and have so been for the past two years. I have had about five or six years' experience operating engines equipped with power reverse gear, that was from about 1923 up to the time I took the present run. I operated those power reverse engines in time freight service between Mason City, Iowa, and Tracy, Minn.

I have never been injured by, or in connection with, the hand reverse lever, nor have I ever had the experience of a hand reverse lever becoming unlatched by itself, jumping out of the quadrant, and going into the corner. With respect to clearance on the hand lever engines around the engineer's seat, I have always had plenty of room. The operation of the hand lever never interfered with my ability to keep a look-out. I sometimes use one hand and sometimes two in operating a hand lever, while sitting on the seat box.

At times it was very difficult with the power reverse gear to maintain a fixed point of cut-off, and in that connection I am speaking about the Alco reverse gear, as they are the gears on the engines I have operated. The difficulty has been that the cut-off would never stay where I placed it. Sometimes everything was apparently all right, and then due to a leak in the piston packing I would have more or less difficulty in keeping the reverse gear where I put it. It would move backward and forward. This was usually while the train was moving.

I have also had difficulty with the piston packing of the power reverse giving out and having to stop and replace it, which would delay me about 10 minutes. That happened only once. However, I have had numerous occasions where I have had to tighten it up. I have had various experiences due to the failure of
648 the reversing gear to respond to the movement of the operating lever—they would not respond to the movement of the lever—I would move the lever, one, two, or three nicks and would get no response from the reverse gear. This always happened while the train was moving, as I never tried out that condition with the engine standing still. The result would be that the engine would work harder than I wanted her to at times, and at other times would not work as hard as I wanted her to. Where the cut-off does not stay at a fixed point, that condition is called creeping. The effect of it on the operation of the locomotive is the valve gear does not stay in position to correspond with the hand lever in the cab. To overcome it I move the hand lever to correspond with the power reverse, and as a rule that brings the power where I wanted it, and sometimes it stays there for quite a while. At other times it will let go and again creep. I have never found any other causes for the creeping, other than the air leaking by the power reverse piston; I have never tried to find other causes. I have had only two engines with power reverse, nos. 1802 and 1754. I have had this condition of creeping quite often on no. 1802, due to her cutting out the packing in the power reverse cylinder. It would be renewed and last a few days, and gradually wear out again. These engines were both of the class Z type. No. 1802 was the engine with which I had to stop and renew the packing at one time. At that time the engine was practically disabled—her valve motion was out. With respect to tightening the gland I referred to, I would do that nearly every trip at some point or other. I have observed the movement of the reach rod that connects the valve gear parts with the power reverse gear cylinder or piston while moving at considerable speed, and have seen the valve gear jumping and the cross head of the power reverse moving back and forth, probably a quarter of an inch or half an inch.
649 I was able to observe that condition by looking out of the window, and it had an effect on the exhaust which was noticeable—it made the engine lame. Around roundhouses and terminals I have noticed movement of the valve gear parts when the operating lever of the power reverse gear was not being moved. I have observed engines standing in a roundhouse pumping up air pressure and the valve gear of the power reverse would move with no one on the engine. This movement was either a jumping up or dropping down. It was all owing to the position of the lever in the cab, how much it would move; sometimes it was very slight, just enough to take up the slack. At other times the valve gear would move two or three inches. Sometimes the valve gear would move very slowly. At other times it would let go at once, that is, while the air was being

pumped up. I have also observed at roundhouses and terminals where an engine equipped with power reverse moved without anyone on the engine. I have in mind only one instance of that kind. That happened about 30 days ago. I was in the roundhouse at Mason City, and there was an engine there being fired up to take out. When she got around 60 or 70 pounds of steam, she started all at once for the wall of the roundhouse. The only reason she did not go through the roundhouse was because there was not sufficient steam. I do not know just where the hand lever was located in the cab, or anything about that, but I do know someone had to get up on her and start the air pump to get up pressure in order to back her away from the wall. I do not know whether the throttle was open. There was a workbench located against the wall at that particular point, and when the engine got against the corner of the workbench, I think it probably helped to hold it. It was not possible to reverse the
650 reversing gear until after air had been pumped up. On that occasion it was necessary to wait until the air was pumped up in order to reverse her.

On May 15, 1929, I was injured in connection with the operation of the power reverse gear, at Fairmont, Minn. The engine was no. 1754, equipped with an Alco power reverse gear. Going into Fairmont on that particular day, my engine began going lame, the valve gear creeping with the heavy train in a bad northwest wind. A passenger train was following me. I had to drop the engine well toward the forward corner in order to make this particular town and get out of the way of the passenger train. After the passenger train went by, I had a couple of cars to set out, which I did, and came back and coupled up to the train. I then got off the engine and looked around me to see if I could see any defects, and the only thing I found was a leaking piston in the air cylinder of the power reverse. The cross head of the power reverse piston was too close to the gland for me to get hold of it with a wrench, so I called to the fireman to throw the lever ahead a little so that I could get up to the nuts on the gland in order to tighten them. I stepped up on the main rod of the engine with one foot, holding to the running-board with my left hand, with a 12-inch monkey wrench in my right hand. When he threw the lever ahead, the engine moved and caught my foot between the eccentric crank and the main rod, cutting off four toes. This resulted in my being incapacitated for 5 months and 15 days. If the engine had been equipped with a hand lever, this accident would not have happened.

My experience is that, from an economy viewpoint, I prefer the hand lever, because it stays where you put it. As between the two types of gear, from the standpoint of safety of operation of the locomotive, my opinion is, well, as a safety appliance, I do not know as I have a choice between them (T. 2295–2310).

651 F. C. MEYER, an engineer for the Chicago and North Western Railway Company, residing at Madison, Wis., age 56 years, testified:

I have worked for the Chicago and North Western for 39 years, 28 years as a locomotive engineer. Those 28 years are the last 28 years except 7 months. When I was off it was while I was a trainmaster in the fall of 1922. I have been operating engines on the Madison division, between Madison and Lancaster, and Madison and Milwaukee, mostly in way freight service, using engines of the R–1 class, which are equipped with hand reverse. I have had very little experience with power reverse. I don't think I have run such an equipped engine over half a dozen times. I have never had any trouble in handling the hand levers. As a rule I had a regular engine. I never had any trouble in reversing it. The levers never worked in such a way that I overstrained or overtaxed myself physically.

In switching I generally sit with my back toward the window and have one foot at one end of the quadrant, and one at the other. I grab it with one hand or two hands. I can sit there and hook her up with one hand and let her down, or use two hands. When I sit with one foot at one end of the quadrant and the other at the other, my feet are right down at the lower end of the stopping block which they have to keep the lever from going way down. They are not on any part of the quadrant where the lever moves, but are outside. I have lots of room to move the lever, and it does not come in contact with my legs and body. On a way freight, there is much switching—switching at all stations, and I do the yard switching at one end of the run. I can look out at most all times and throw the lever. Neither in switching nor in any other service have I experienced any difficulty in keeping a look-out or observing signals while operating the hand lever. I have never had any occasion where the
652 hand lever became unlatched in the quadrant and went to the corner, neither have I had the lever get away from me after I had unlatched it. I have noticed that when levers rattle the valves are dry and in such cases I would let them down a little, ease off on the throttle, and lubricate the valves. Then they would quiet down in a short time. I have always been able to maintain any desired point of cut-off with the hand lever.

At the present time I have a bad rupture, which I have had for five years. I had an operation on my stomach five years ago and was off about 60 days. I worked about five weeks and a car got off the track. I was lying on my back reaching for the frog to place in front of the wheel and in so doing I tore the ligaments and got a sharp pain. About 30 minutes later I got six—I did not feel very well that night but went out the next day, and upon my arrival at the other end I laid off a few days and felt fine. I did not feel any more pains, went back to work and have not had any pains since. I have done nothing for this rupture except use a cloth bandage. Handling of the hand lever has no effect upon that rupture.

I do not know anything about the power reverse as I have handled mostly the hand lever. I do not know whether the power reverse would be any better than the hand reverse (T. 2310–2318).

F. C. MEYER, on cross-examination, testified:

I have not had very much experience in passenger or in through-freight service. I have had mostly way freight and switch engine runs, most of my runs being in way freight and in which service I have used engines of 130,000 pounds on drivers, so that when I speak of reversing engines without difficulty I refer to engines of that size. In way-freight service I run from 20 to 35 miles an
653 hour, and I should say I am going about 10 miles an hour when I hook up the engine the last time. I do not brace myself in hooking up the engine. Sometimes there is a rattle in the lever, which indicates there is a pull on it coming mostly from lack of oil. Before the lever gets to rattling too badly, I let it down and ease off on the throttle and that quiets it. I feel a strong pull on the lever when it is rattling. On the occasion that I strained myself, I brought the engine in and did not feel any effects from it, except that I was sort of weak. The fireman did not handle the lever for me (T. 2318–2321).

654 PIERCE J. WELSH, an engineer employed by the Chicago & North Western, residing at 816 Avenue C, Council Bluffs, Iowa, age 65 years, testified:

I was employed by the Chicago & North Western as a fireman on February 14, 1888, and promoted to run an engine on August 6, 1892. I have been continuously in service as an engineer since August 1, 1897. Between 1892 and 1897 there was a break, I having been set back to firing and then promoted up and down. I have operated in the territories between Casper, Wyo., and Missouri Valley, Iowa, Omaha, Superior, Lincoln, and Hastings, Nebr., Bonesteel, S.Dak., and the Sioux City division. I have also operated as far as Deadwood, S.Dak., Belle Fourche and Casper, Wyo. I have operated trains throughout all seasons of the year and have used the standard engine, 17-inch engine, 18 × 24-inch engines, classes Q, R, R–1, E–1, and E, and also for a few days, class Z. In the early days of my operating engines I did not have air brakes but used the reverse lever for braking purposes. When using this lever for braking purposes, when you get a signal to stop you put it back and when you get a signal to go ahead you put it the other way. Before coming to a stop you shut off the throttle and that reversed steam in the cylinder and acted as a brake. I performed this operation regardless of speed as it was switching service in which I was operating. In those days the passenger engines that we had were a 16 × 24, Little Blood engine. I do not know whether with the end lever I could reverse the larger locomotives which are in service today, but with the class of engine I have run so far I could do it. The largest locomotive I have run is a 23×28-inch carrying nearly 200 pounds of steam known as class E, a 4–6–2 engine. That engine weighs 154,000 pounds on drivers and has a Walscheart gear. I have not with
655 that engine had occasion to use a reverse lever for braking purposes but I have on the class Q engines, and averted a collision

by use of the reverse lever on a passenger run. In that case I was coming down hill and had a "run-line" order on a passenger train coming down the hill possibly five or six miles in length at night. As I rounded the curve I saw a headlight approaching, I applied the brakes in emergency and reversed the engine and thereby stopped before we came together. I would judge we were within 10 feet of each other at the time we stopped. This class Q engine weighs 108,575 pounds on the drivers and is equipped with a Stephenson gear.

I have operated an engine equipped with power reverse gears only one day and that was 37 miles each way. All my other experience has been with a hand reverse and I have always been able to handle them without exerting myself in any manner, the manner of operating them depending on the location of the quadrant. If the quadrant is located alongside the boiler I stand up to reverse them, hook them up or let them down. Sometimes I use one hand and sometimes two. I generally use the left hand to get the feel of the latch and the right hand to hold it. If the quadrant is located on the back of the boiler head, I generally sit straddle of it and sometimes sit right in one position looking straight ahead and handle it with one hand. By sitting straddle of it I mean with the lever so that I can look ahead or look back with the lever between my feet. The position of my feet is one at each end of the quadrant. In operating these hand levers in the way mentioned I have always had plenty of clearance.

I operated engine no. 2206 during the years 1917 and 1918 or 1919 and 1920 continuous for 18 months. I had that engine which is of the class E–1 for several trips winter before last in passenger
656 service operating between Norfolk and Council Bluffs, Iowa, and found no difficulty in operating the hand lever with which it was equipped. In comparison with other engines, I found that it handled as easy, if not easier, than the lever on engine 2224.

I have had experience in breaking in engines and on such jobs I was always able to handle the reverse lever myself. Of course, some would handle rather stiff because the engine was put up tight and had just come out of the shop. That was in 1902 and 1903, and it was all Stephenson link motion at that time. In those days our power was 17 x 24 and 18 x 26. I was known as the "lion tamer." I never found one of those engines hard to operate. I generally handled them for three days and sometimes I would have one which would take the thickness of a piece of paper in the link block to make them easy to tame. The way I did that was to loosen the bolt in the link, and release the pressure on the link block. That was a matter of adjustment which could be removed in a day or two after you got the "lion" tamed.

I have never been injured by or in connection with the operation of a hand lever, nor during my experience found anything unsafe about them (T. 2321–2328).

PIERCE J. WELSH on cross-examination testified:

On the occasion when I averted the collision using the lever to brake the engine I was going between 35 and 40, or maybe 45, miles an hour down grade, 65 feet to the hour. I put the air on in emergency and applied it. When I put the lever in reverse it
657 actually reversed the engine and she got steam enough to hold it in reverse. The wheels did not spin in back motion, they were on sand to hold them from sliding. After I reversed the engine the wheels were moving in reverse direction from which the train was going. I did not think there was any danger in that.

When going along with the passenger train and I want to hook up the lever or drop it down I feel of the latch and I do that to find out whether it is going to jerk me or not, the valve might be a little dry or drag a little water into it. If I had reversed this engine while coming down hill without applying the brakes I would have bunched the train up.

Referring to engine no. 2206 which I had during a particular winter I could not tell exactly how many times I had it (T. 2328–2331).

A. SHOCKLEY, a hostler for the Chicago, Burlington & Quincy Railroad, residing at Creston, Iowa, age 63, testified:

I was hired by the Chicago, Burlington & Quincy in 1892 and classified as a hostler about 1904, prior to which date I had worked in the labor gang cleaning fires. I had handled some engines before 1904. Since that year I have been continuously employed by the Chicago, Burlington & Quincy as a hostler in the same place, Creston, Iowa, at which there is a roundhouse and a shop. I am employed in the roundhouse and at the present time handle something like 10, 12, and 14 engines each day. Several years ago I handled as high as 45 or 50 in a day of 12 hours at which time I spotted the engines at the coal chutes to take coal, then took them to the pit, knocked the fire out, cleaned the fire and then took
658 them in the roundhouse. That is the same thing I am doing with the engines today. I at one time used to bring the engines out of the roundhouse. I have handled engines equipped with power reverse since about 1912 and handled them every day, together with engines equipped with hand reverse. I handle about as many of one as I do the other. There are now 32 stalls in the roundhouse whereas in 1916 there were about 60. In 1916 I handled an engine no. 5263, type 0–2, wheel arrangement I think, 2–8–2, weight on drivers 227,000 pounds. I was taking it out of the roundhouse where it had been setting in stall no. 21 facing the wall. In order to get it out of the roundhouse I had to back it. The engine was under steam and I got on it and started the air pump. I next came down on the right side and went around the engine to see whether there was anybody under it or around near it, and

came back to the right side. I passed around the front end of the engine and saw no one under or around the engine. The only thing I found under the engine were the blocks which I pulled out and then climbed up on the engine. As the engine stood in the roundhouse there was what was called a desk in front of it. However, as I passed around the engine to make my survey there was no one sitting at that desk. The boilermaker foreman of the roundhouse and the boiler washer regularly worked at that desk. The name of the boilermaker foreman was Bradley. When I got in the engine I looked at the steam and air and found 60 pounds of steam and 40 pounds of air. My experience previous to that time in handling this and other power reverse engines with an air pressure of 40 pounds was that I always pulled the reverse lever back, and previous to this time I had been able to reverse a power reverse engine with 40 pounds air pressure. This particular engine
659 was equipped with power reverse, having a hand lever in the cab. After observing this air pressure and steam pressure I pulled the reverse lever back to the corner and when I did I heard a noise like an exhaust of the reverse air cylinder and that indicated to me that the engine had reversed. I then opened a throttle to give her steam, she did not move and I moved her a little more. She made a jump and went ahead until she hit the desk to which I have referred, the pilot just touched the wall but did not mark it. Another engine was obtained to pull it back, Mr. Hessel said to move the engine back, that there was a man in between it and the wall. Mr. Hessel was boilermaker foreman of the shop and was at that time on the floor up ahead. Bradley worked under him. When Mr. Hessel said this I pushed her ahead and pulled her back again but she would not come back. I was not able to get her reversed until she was pulled back by the other engine. The other engine pulled this one back just enough to get the man loose in front and they took him into the roundhouse office. I went up to the roundhouse office and looked in the window and Bradley was lying on the table and a railroad doctor came up and examined him and I skipped out, I could not stay any longer, I did not want to stay and did not go to his funeral. After that occurrence I did not see Bradley again.

If when I made the inspection of the engine I had seen Bradley at the desk I still would have made the movements of the reverse lever as I did.

With hand reverse engines I have never had the experience of throwing the hand reverse lever into reverse and have the engine go forward (T. 2331–2345).

660 A. SHOCKLEY, on cross examination, testified:

On the occasion that this man was killed I gave a warning that I was going to move the engine by ringing the bell. I had observed the position of the valve motion and it was set ahead, the lever was also set ahead. I have never had any instructions as to

how much air pressure there should be before starting an engine and the company has not since that accident issued to me any instructions of any kind with respect to handling the engines. I still handle the engines in the roundhouses with the air pressure at 40 pounds or so. I have never had another occasion of an engine going through the wall of the roundhouse, nor have I ever had any other case of an engine going in the opposite direction from which I had set the reverse lever. I could not see the valve motion from the cab without leaning away out of the window. I do not think I have ever received any instructions to throw the reverse back and forth two or three times when I first get on the engine, but I have always done that since the accident. On those large engines there is now a lever which indicates the reverse, but that was not on this engine with which I had the accident (T. 2345–2347).

A. SHOCKLEY, on redirect examination, testified:

I have forgotten the name of the type of power reverse on the engine with which I had the accident. (For the purpose of the record it was developed that the engine was equipped with a Ragonnet gear.)

This accident was investigated by the company, but I was not blamed in any way for it (T. 2347–2349).

661 CHARLES HINTZ, a locomotive engineer for the Chicago & North Western Railway Company, residing at Green Bay, Wis., age 59 years, testified:

I was first employed in 1891 in the shops. I went into engine service in 1897 as a fireman and was promoted to engineer in 1902, since which time my services as an engineer have been continuous. I have operated on the Lake Shore & Ashland division and a part of the Wisconsin and northern Wisconsin divisions. These divisions are partly in Wisconsin and partly in Michigan—the northern peninsula of Michigan. The tracks extend in various directions from Green Bay. I have had experience in all classes of service and have run every engine that the North Western has with the exception of the new H's, J–4's, L's and I believe the E–'s. Off and on for the last five or six years I have run engines equipped with power reverse gears. At the present time I am operating a through passenger train between Milwaukee and Antigo, Wis., via Green Bay, and the 2 engines on this run are equipped with the Alco power reverse gear. I have also run in a similar type of passenger service engines equipped with hand reverse. Besides the power reverse equipment to which I referred I handled other types but not to any great extent. I have handled the Ragonett and Barco, aside from the Alco. Other than the power reverse gear engines to which I have referred the remainder of my experience has been with the hand lever type. With the hand lever type I have always been able to control the cut-off wherever I thought it was practical to use it. I can recall only one instance where the hand lever became unlatched

in the quadrant of itself, going to the corner, and that was on a freight engine double-heading my train in a snowstorm. I was required to leave the regular engine next to the train and take
662 the lead engine. There was a great deal of snow in the cab, the engine was covered with snow and it was the snow and ice together with the partly worn condition of the reverse lever quadrant and the latch which caused the hand lever to become unlatched. On this occasion I was moving forward and it went into the forward corner. In order to remedy the situation and keep it from happening again, I put an 18-inch monkey wrench between the latch and the lever and closed it up so that it would remain there and I had no further trouble with it. I reported that condition upon arrival at Milwaukee and it was taken care of, and I am quite sure I had the engine afterwards as it was used at different times that winter in double-heading passenger trains. I had no further experience of this kind with it.

I have only two occasions in mind where the hand lever pulled away from me after I had unlatched it. On one occasion I had just tipped over the top of a hill and had a long stretch of comparatively level track to travel and of course it is necessary to get the engine at the proper point of cut-off. However, I waited too long and was getting too much headway and the speed was a little greater than I had intended it to be and when I went to unlatch the lever it went down to the corner but that didn't have any effect upon me or the train as I eased off on the throttle and set the brake on the train and slowed down, the fireman immediately knew what had happened and we both got hold of the lever and pulled it back into place without slowing the train down—well we slowed down to possibly 30 miles an hour. I had a similar experience about a year later and these are the only two that I can recall. My experience with maintaining a fixed point of cut-off with the power reverse gear has been that I have not always been able to maintain such point. The cut-off would not stay where I put it. About 10 years ago I had a case on engine 1661 where it came up after I
663 was about a mile and a half from Milwaukee. On that occasion I had quite a heavy train consisting of 14 cars and I noticed the engine started going lame, and very much so. I eased off on the throttle and increased the point of cut-off and in that way got along until I reached the regular shop where I found that the stuffing box on the piston gland of the reverse gear was leaking badly. I tightened it up and didn't have any further trouble, and again about a year and half ago I was on train 111 at Fox Point, Wis., I just passed over a slow speed piece of track and reached a point where our speed limit was 60 miles an hour. I was going between 50 and 55 miles an hour when the power reverse put the gear in reverse motion. I had not touched the operating lever for some distance. I had already hooked the engine up where I figured it was going to handle the train for the desired speed but after it had gone for some little distance all of a sudden this gear put

the engine into reverse. The engine seemed like she was going to buckle up in the middle. It started to puff steam, smoke, and fire out of the bent tubes, etc. I immediately eased off on the throttle and grabbed the reverse gear lever and put it down into the forward corner. There was considerable jerking on it but the gears seemed to respond. As to the jerking when I unlatched it I could feel there was a strain on it and when I put it into the forward motion it stayed there. I started setting the brake on the service application and of course immediately when the power reverse responded and went into forward motion again the knocking and so-called tearing of the engine ceased and she quieted down to a normal condition. I released my brake and gradually opened up on the steam throttle and everything was apparently going along all right. I did not stop. At the first regular stopping point the fireman and I got
664 down and gave the engine a thorough inspection because we were satisfied there must have been some damage done but we didn't find anything. We couldn't find that there was anything wrong. We inspected that portion of the power reverse gear which could be seen and we couldn't see anything wrong—everything appeared to be in its proper place. We started out again and at a point about 10 miles away while going at least 60 miles an hour I could feel that the power reverse was again going into backward motion, but before it repeated the performance I got the lever down in forward motion to full stroke and the gear responded. I gradually opened up again on the throttle and brought her up to a little over half the point of cut-off. The first time that engine went into reverse she was hooked up about 25 percent or about a 6- or 8-inch cut-off and I would say it was about three notches off the center. After that I tried to stay away from that point as much as possible. On that trip I did not observe the movement of the valve gear or the cross head on the reversing-gear cylinder as I didn't have time. The fact is that when this gear went into reverse the engine was knocking and pounding so much I didn't have time to look, it seemed like the engine might go off the track. At no time during that run did I observe the action of the cross head because this was a night run and I couldn't see. The locomotive was no. 1662 equipped with an Alco gear.

*My experience with regard to creeping is that* I have had it happen at different times, but as a rule after it was reported it would be taken care of (T. 2350–2361).

665 CHARLES HINTZ, on cross-examination, testified:

As to whether there is a point at which you are going too fast with a manually operated engine to safely handle the reverse lever, I would say that that would depend much upon the condition of the engine. I have never found a time when I could not change my point of cut-off if I would take the proper precautions; and by taking the proper precautions I mean if I found my engine was dry because of lack of lubrication and the reverse lever was rattling a

great deal with a strain there, I would probably brace myself in a position so that I would know that I could handle it and I would sort of feel of it before I would unlatch it. I would find out how much of a strain there was before I would let it get to a point where it would get away from me. I could pretty well tell how much of a strain there would be, and if I thought the reverse lever would be hard to handle and would be liable to get away from me I would brace myself in a position where I was sure I could handle it before I would unlatch it. I have had such experience. I have had the assistance of the fireman on two occasions in pulling the lever out of the corner, because at the time we were traveling at a high speed, and in order not to come to a stop or decrease the speed of the train to a great extent, the fireman rendered me assistance on the lever. But I did not ask him for it. To my knowledge, a fireman has never helped me take slack when operating a passenger train. If the notches in the quadrant and the latch are worn, it is my judgment that there would be a likelihood of the lever going to the corner.

If there is lost motion in the parts of the lever or the reach rod, or the bearings of the valve motion, that contributes a rattle
666 to the lever. The lever would not work back and forth if the notches are in normal condition, but if they are worn it would.

I have had power reverse for about five or six years, and have been on the present run for about two years. On this run on which I have been for the past two years, there is one regular engine equipped with power reverse and one with a manually operated lever.

The only time I experienced the reversing mechanism going into back motion was in August 1925.

It is possible to hook up an engine equipped with power reverse too close to the center. To the question, "And it is not good practice to get too close to the center?" the witness replied, "I am not known for that." On the occasion which I refer to, where I had the engine hooked up to within three notches from the center, it was not too close, as that is where the engine had been running all the time. There were three men using the engine, and they had a corner broken off on one of the notches up to which they bring the lever, and it is supposed to be the notch that the engine is doing the best work on when she is properly hooked up. That is where I was running her. The fireman never said that I worked her hooked up too much (T. 2361–2365).

CHARLES HINTZ, on redirect examination, testified:

When I say there was a regular notch at which the engine was run, I mean at high speed, which is about 60 miles an hour. On the two occasions when the fireman helped me to move the lever off the corner at high speed, I can not say that I experienced or observed anything in connection with that operation which placed either me or the fireman in any danger.

CHARLES HINTZ, on recross-examination, testified:

At the times the fireman helped me move the lever out of the corner, I had reduced the speed to about 30 miles an hour.
667 I don't think either I or two men could have pulled the lever out of the corner at a speed of 60 miles an hour. From my experience there is no occasion for operating a locomotive which requires it to be hooked up at a speed as high as 50 or 60 miles an hour (T. 2366–2367).

O. B. LINDQUIST, a locomotive engineer for the Chicago and North Western Railway, residing at South Beacon, Ill., age 51, testified:

I was first employed in the engine service of the Chicago and North Western Railway as a fireman in 1902. I was promoted to engineer in 1908, and have been practically continuously employed since that time. I have operated in the Galena and Southern Illinois divisions, mostly in freight service, with a little passenger and a very little switching, and have operated practically all the types of engines that the North Western has, except the "H" and "E" types.

I have used power reverse gears ever since the North Western has equipped its engines with them, that is, since about 1912, my first experience being with the Mellin type. I have also had experience with the Ragonett, Barco, and Alco. Since 1914 I have had very little experience in operating engines equipped with hand reverse. When operating with a hand reverse, I never had any experience with the hand lever getting away from me or out of my control. With the hand reverse I was able to maintain a fixed point of cut-off. With the power reverse I have difficulty with them creeping and jumping. By creeping I mean that it will not stay at the point of cut-off where the reverse lever is set and latched. Jumping is practically the same thing, only faster. It often happens that power reverse gears fail to respond when I move the operating lever—that is, if you move the lever one or two
668 nicks the reverse gear will not respond, and if you give it one more nick it will take them easily. The lever either goes down too far or up too far, and if it goes down too far the engine is working at a longer point of cut-off than necessary, and if it happens the other way the engine goes over center and goes into back motion. On a number of occasions I have had the reverse gear move back past center when the engine was moving forward. On those occasions the engine gets into a "terrible commotion." I have had them reverse probably at 35 or 40 miles an hour, and on those occasions I eased off on the engine but have never had anything break as a result of such action on the part of the reversing gear. I have observed the cross head of the power reverse moving back and forth when the engine was creeping. This movement would make the exhaust sound very irregular, and cause the burning of more fuel and the use of more water. It caused the engine to work harder. That was back in 1920 or 1921, when we were using the

Ragonett power reverse. At the present time I am having a little better luck with the power reverse gear, it being a Barco, although I occasionally have trouble with that one in the form of creeping.

I have had delays owing to the action of the power reverse, especially when it froze. That was possibly three or four years ago when we were using the Ragonett. On that occasion I came to a coal and water station at Lick and stopped. The reverse gear would not go down in forward motion. I tried to reverse the engine but could not. Of course, the engine started at the point where I had been working her. I looked the engine over but did not find any place where anything was wrong. However, I noticed a drain cock on the steam line to the reverse gear was frozen and opened the drain cocks in the reverse cylinder. They were frozen and I had to thaw them out.

A little water ran out of them, but I had to thaw the reverse
669 cylinder, with the result that water ran out and that was all there was to it. That is the only case I ever had with freezing. I have noticed engines standing at roundhouses when pumping up air, that the reverse gear would start to move without anyone in the cab operating the lever. The movement would be back and forth. sometimes the movement would be easy and at other times it would be a jerk. I have never been injured on an engine equipped with either the hand lever or the power reverse. I would think for the reason that I have mentioned, about the gear creeping when no one was handling the engine, that the hand lever would be the safer (T. 2367–2378).

O. B. LINDQUIST, on cross-examination, testified:

As to which is the safer for the engineer, the small short lever on the power reverse or the long lever on the manual reverse, well, as far as the lever is concerned, I don't see that there can be but very little difference, if any. In handling a manually operated lever, one should keep his feet out from where they might get caught and should brace himself properly. My experience has been that it is necessary to brace one's self when handling the lever with the train in motion. I brace myself in order to be sure that I will be able to handle it properly. That is a precaution against any jerking on the part of the lever. One would not have that experience with the power reverse unless it was one of the old Mellin type, which was more dangerous than all the reverse I ever saw. With that type I have stood on the deck and hit it with a coal hammer, that is, hit the latch, and that lever would go back and forth over the quadrant when I did not want it to. The bar on the Mellin gear was about as high as one's shoulder, high enough so that it could be handled sitting down. It was about the same height as the manually operated lever, and when that bar went back and forth in the quad-
670 rant, it did so with considerable force, which was very dangerous, as they had a cross latch on them and if a person should unlatch it, it was liable to break his arm. Any lever that would go back and forth in the quadrant as fast as that one is dangerous.

When I was operating hand levers prior to 1915, I was in road freight service, handling the "Z", the "R", and "R–1" types of engines, which were the smallest on the road. Most of my experience has been with the smaller engines, that is, up to the "Z's." There were some of the smaller locomotives equipped with hand levers that were harder to handle than the larger ones also equipped with hand levers.

The "Z" class of engines are now equipped with power reverse, and if I had my choice on the "Z" engines I would take the power reverse. It was possibly two years ago that I last observed the power reverse gear going into back motion. I don't know whether that trouble has been overcome as I do not handle that type of engine at present. I don't know what improvement has been made on the Ragonett gear since I used to observe it creeping (T. 2378–2383).

O. B. LINDQUIST, on redirect examination, testified:

The reason that I prefer power reverse on the class "Z" engines is because it is a little easier and it gives me more room.

Before I had the power reverse on those engines I never experienced any undue exertion physically in handling the hand levers. As to whether I felt any more worn out at the end of a day's work with the hand lever than with the power reverse, there is not enough difference between the two to make any impression.

In all my experience with the hand lever that has moved back and forth in the quadrant, I have never seen one that did so in the
671 manner that this old Mellin power gear lever would. I have never handled a hand lever which placed me in any danger (T. 2383–2387).

C. A. JEFFERS, fuel supervisor of the Chicago and North Western Railway, residing at Boone, Iowa, age 53, testified:

I have been in the employ of the Chicago and North Western Railway for 35½ years. I was employed October 14, 1895, as a roundhouse laborer and had three years of roundhouse work, including night foremanship and foremanship. I fired a locomotive until 1903, was promoted to locomotive engineer in 1903, ran a locomotive until 1919, was road foreman of engines 1919 until 1922, and was fuel supervisor from 1922 to the present time. I have jurisdiction over all territory in Iowa and Illinois.

Since the period of my active service as an engineer ended, I have operated locomotives and fired them quite frequently, sometimes every day and sometimes there would be a lapse when other duties would take me off an engine and I would handle them for only a short time.

As fuel supervisor my duties are to ride locomotives, instruct and demonstrate proper performance. I also have various other duties. My duties are also to get the best results out of a locomotive by maintaining desired points of cut-off and to see engines worked to the best advantage in the different services.

In checking up work reports, the performance of an engine as regards the cut-off and distribution of steam is of great interest to the fuel department.

During my period of service I have operated every class of engine the North Western owns, except class "B," of which there are only two. I was never on a class "D" engine. I have run and fired engines on other roads for short distances at the invitation of the men in charge.

672 In my entire experience I have never been injured in any way by, or in connection with, the hand reverse lever, nor observed or seen anyone else injured thereby.

For several years past I have been riding on engines equipped with power reverse gears and have observed their performance. I have also handled them in road service and around roundhouse tracks in order to determine defects.

With an engine equipped with a hand reverse the desired point of cut-off can always be maintained. I would not say always, but generally you can maintain the desired point of cut-off, especially with an engine with worn parts. The desired point of cut-off can be maintained better with a hand lever than with a power reverse, as the hand reverse lever, as a rule, stays where it is put and that is very essential in order to have proper steam distribution. I have never had a hand reverse lever jump out of the quadrant. I have had them go to the corner from some broken part which should hold them in place, but that would not in any way endanger me as long as I stayed in the clear. It might pinch me if I got in the way but I always stayed out of the way, as there was never any occasion for me to be in the way.

Sometimes the power reverse gear works fine and sometimes they fail miserably to get the proper distribution of steam. When a power reverse gear creeps, especially at high speed, it throws a terrific strain on different parts of the locomotive and is a dangerous proposition inasmuch as, with an engine that is reversed at high speed, there is an element of danger involved there and it would be hard to determine to what it might lead. I think only a man who has experienced a performance of that kind and felt the bucking of an engine and the terrific strain can have some idea of what might occur, and I have such experience.

673 On May 21, 1931, engine 3002, on express train no. 6, the power gear failed to hold the valve gear at the proper cut-off. The engine reversed herself running at a speed between 60 and 65 miles an hour, and this happened two or three times in 15 miles, so I took the engine off the train. What lurching there was of the train could not be noticed at that high speed. The sudden movement could not be very much. The engine did not reverse itself so as to come back over the center and get the wheels going in reverse motion, but it would reverse itself to the extent that I could feel there was steam trapped and there was terriffic strain on the loco-

motive in order to right herself. Only a few days before this an engine of a similar class on the same train broke down, but I was not present at the break-down. I saw the broken parts of the locomotive and have authentic information which would convince anyone that it actually happened. The information is from the road foreman and the engineer who handled the engine. I have the engineer's work report with me. (Work reports were admitted in evidence and marked defendants' exhibit no. 25.) Referring to the incident with engine 3002, I was riding on it at the time of the trouble. It was a class " H ", 4–8–4 equipped with an Alco power reverse gear. Another instance occurred on February 7, 1931, with engine 3019, on which I was riding. While handling a 115-car freight train the reverse gear started creeping, and while creeping a drawbar was pulled out. This creeping was causing the ports to open wider and give the engine more steam, and that caused the train to surge. The engineer was trying to control this with the lever, and going through a sag and stretching out on the other side, a drawbar was pulled out. The engine surged ahead and jerked this bar out. A drawbar is hardly every pulled out, it is jerked out. That locomotive was equipped with an Alco power reverse.

674 On July 15, 1930, while standing alongside engine 2313 in the Clinton roundhouse, the engine went into the roundhouse wall. The lever of the power reverse was on center and when the air pressure was applied the gear began chattering or shimmying. Shortly after I heard that noise, the engine exhausted a couple of times and went into the roundhouse wall. There was no one in the cab. This shimmying occurred before the engine moved. I was standing in the next stall and when I heard the racket there I started around to the engine. My idea was to set the rotary valve in the Alco gear and stop the movement in the gear, which quite often happens. That generally stops them. Before I got around to the engine, she moved ahead and went into the wall. The lever was on center, but the valve gear was far enough in forward motion to open the ports in forward motion. The air was only pumped up to 40 or 60 pounds. The throttle was shut off, but there was some steam coming out of the cylinder cocks. I would not say that the throttle leaked; it might have been steam that was left in the units of the engine, trapped in there. The engine had fire in her. She had been in the roundhouse for some time. I don't know just how long. I would not say that the throttle was not leaking, although it did not leak enough so that any report was made of it. It might have been opened a little bit due to sediment of some kind being in the throttle valve and blown out, but I would not say how it happened. This engine was not dead (T. 2387–2397). There was a fire in it. Ordinarily an engine will not get enough steam to walk off from the superheater unit. However, if there is condensation in the units and it evaporates into steam, sometimes an engine will walk off and it will be hard to account for it. This happens a number of times.

Instructions have been issued to blow out units and make sure they are well blown out when there is any work done on the engines.
675 This particular engine was blocked, but she got enough steam to run over them. Sometimes the blocks do not hold as well as others, as there might be a greasy condition around the engine and the blocking. This engine crushed the block down enough to get by—that would take quite a good steam pressure. The engine was a class "J." A test was made with respect to the power reverse gear by pumping up the pressure and then letting it down. The power reverse gear crosshead would move some when the pressure went down. An investigation was made as to where the engine got the steam. We tried her out for a throttle leak and for dry-pipe leak, but there did not seem to be enough to amount to anything. She did not have enough of a leak to warrant killing the fire. No work was done on her.

On the previous occasion, on engine no. 3019, I made an investigation after the accident as to the condition of the power reverse gear and found there was a leak around the piston stuffing box gland. That was all I found.

With respect to engine 3002, I made an investigation and found the rotary valve needed changing so the piston was taken out and turned up, after which the engine held. I rode the engine the next trip and she held very well.

The weak part of an Alco gear is the continual wearing of that piston in the center and it is hard to keep the piston packing tight for that reason. When they are working their best there is always a little movement of the Alco gear in the center of the cylinder. This wears that piston smaller in the center, and it is hard to keep it tight.

Referring to the incident with engine 2306 at Clinton, Iowa, on June 15, 1930, this engine was equipped with a Ragonnet gear and went into the wall of the roundhouse. The house pressure was applied on the engine and it was going down; it moved the
676 valve gear in forward motion enough so that she got enough steam in the cylinders and went into the roundhouse wall. I was present on that occasion and noticed that the operating lever of the power reverse was as near center as it could be placed. The air pressure was going down. The house line was connected to the engine for a test. As I remember it there was around 50 or 60 pounds of air at the time I got up on the engine and looked, which was right after the engine went into the wall. The cylinder cocks were closed, although they are not ordinarily left closed when an engine is standing. The engine was blocked. But I do not recall whether she went over the blocks or pushed them out of the way. She obtained steam by reason of the fact that her throttle was leaking a little and her cylinder cocks were closed. After the acicdent I examined the reverse gear and found there was not very much lost motion in it, but the slide valve of the Ragonnet gear had evidently moved

enough so that the engine got steam. This valve was evidently moved by the weight of the valve gear.

Referring back to the case of engine 3002, there was a delay of 25 minutes in a 36-mile run. On the occasion with locomotive 3019, freight train at Jefferson, Iowa, there was a 45-minute delay getting rid of the broken drawbar.

Referring to an occasion on January 26, 1929, with engine no. 2136 at Council Bluffs, Iowa, which engine was equipped with an Alco gear, she climbed over the blocks and went into the turntable pit. I was present at that time and the hand lever in the cab was on center. The hostler had shut off the pumps, and the air pressure was going down when this happened. The general foreman and I made a test of the power reverse gear, pushing the pressure on and letting it go down, and found the crossheads would move in the guides. We had the house pressure on and, as I remember, it
677 was between 40 and 50 pounds. When the crosshead moved, the movement was far enough to open the ports and get steam in the back motion. The hostler said he opened the cylinder cocks but they were found closed when the engine went into the pit. Sometimes the pressure will close the cylinder cocks. They don't always stay open. A thorough test was made of the throttle of that engine and no leak was found. The only way that I can account for the fact that the engine had enough steam to climb the blocks is that when the engine was put in the roundhouse she was filled full of water and water enough was carried from the boiler into the units to make steam after she had stood there a while with a hot fire. I don't know of any other way this accident could have happened as there was a pretty thorough test made of the throttle. While I wasn't there when the test was made, the general foreman has a statement on file. I did go with him to test the reverse gear (T. 2397-2404).

I refer to another instance on September 10, 1928, at Council Bluffs with locomotive no. 2179. This engine was equipped with Ragonett gear and had just come in on the roundhouse track from switching service. I was standing beside the engine, having come in with the switch crew. The engine moved ahead a couple of feet and bumped into another one. I found the lever on center and the valve gear seemed to be just a little ahead of center. The air pressure was pumped up and there was no one in the cab at the time she moved.

On those other occasions I have referred to, there was no one in the cab, to my knowledge. In this last-mentioned case the throttle was leaking a little. There was a little steam coming out of the cylinder cocks, but not enough to move the engine. I do not know where the steam came from to move her unless it came from the condensation in the units, after she had stood there and gotten hot. The cylinder cocks were open.

678 I had another instance at Council Bluffs where the air was pumped up on the engine, but the pumps were not shut off as

they are never shut off until the engines are put into the roundhouse. This was engine no. 2420, which I had ridden that day and which had arrived at Council Bluffs at 3:40 p.m. It was equipped with Ragonett gear. While standing on the coal shed track after arrival, the pump stopped. It had been groaning a little from lack of lubrication. There was a pressure of between 40 and 50 pounds when I got up on the engine. The lever was on center. I had my hand on the valve cross head when this engine moved ahead and struck engine 1877. At the time I was standing with my hand on the valve cross head, I was standing beside it as I had just gotten down from looking for air leaks in the smoke box. There was no one in the cab of the engine and the position of the lever was on center. In that case I would judge the engine got the steam to move her either from the throttle leaking a little or from condensation in the units as a result of water having been carried over to them. The cylinder cocks were open.

In the instances I have referred to, if the engines had been equipped with hand levers and the levers had been placed in center position, it would not have been possible for the valve gear to move so as to permit the engine to move.

I had difficulty with creeping on engine 2412, hauling a train out of Ames on May 15, 1930. This engine was equipped with a Ragonett reverse gear, and as a result of her creeping, water was raised in the boiler and thereby dried the valve. This resulted in quite a little trouble in getting over the hill out of Ames yard. This creeping was in the forward motion. We did everything we could to settle the engine down, but she raised water just the same. Water was thrown out of the stack to such an extent that we did not have much left in the boiler. The engine had not been foaming; she
679 had been properly blown out and I had ridden on her over 200 miles. Water is raised by reason of working an engine too hard for the speed. You get all of the steam out of the top of the boiler and the water then comes out through the valve. We were carrying water around two-thirds of the glass when she started raising. I was not running the engine, only riding on her. The boiler was not foaming, because I would have noticed it. It was when the gear took her into the corner that water came out of the stack. To a certain extent we could cure this by easing off on the throttle, but we wanted to use the steam to get the train over the knob. The engine was hooked up at probably 35 percent cut-off and on the quadrant that would be about five or six notches ahead of center. We were moving at about 28 or 30 miles an hour when the water started to raise (T. 2404–2410).

Referring to an incident which took place on April 5, 1928, with engine 2910, what took place was that the engine crept badly the entire trip between Chicago and Clinton, both eastbound and westbound, a distance of 138 miles. The engine was a class E–2 equipped with a Barco gear. On that trip an excessive amount of fuel was

used. This creeping was noticeable on the head end of the train to such an extent that the baggageman asked what was going on.

I have experienced and observed creeping numerous times. There has been a lot of it, and results in burning an unusual and excessive amount of coal. There is nothing more discouraging for a man who is handling fuel than to have it licked up and gone without any benefit whatever. Creeping has not been confined to any particular type of power reverse gear. All that we have do that and they are the Barco, Alco, and Ragonett. Most of my experience is with the Barco and Alco. The Ragonett is mostly on transfer and switch engines where the point of cut-off does not make the difference that it does in road service.

680 I have had considerable experience with the so-called jumping effect, that is, where the gear would not respond when the lever was moved a notch or two. I have had experience where in notching engines they would not take the second notch, third or fourth, and sometimes it is necessary to move the lever five notches. The effect when that happens is excessive working of the engine for the speed they are going, using more coal than necessary, and terrific strain on the valve gear and other parts of the engine.

Several times on engines in roundhouses I have noticed the so-called "shimmying" movement of the valve cross heads or valve gear parts on power reverse gear operated engines, and I have ridden on the running boards of engines while in motion and watched the power reverse gear crosshead moving in the guide more than it should. I have seen it move from a half an inch to an inch and a half at times when the engine would be running, and this resulted in excessive use of fuel, and caused a loud exhaust, an unusual noise at the stack, due to working the engine harder than it should be. There was also a terrific strain on the valve gear and other parts of the engine. The effect upon the action of the valve cylinders in the steam chest would be that sometimes water was carried over and there would be a disastrous effect upon the valve rings and cylinder packing (T. 2410–2413).

681 June 18, 1931

R. S. RASMUSSEN was recalled and testified:

The time my arm was caught in the valve gear I hallooed. The general force around the pit notified the fireman in the cab that I was caught and he reversed the engine and let me out. The engine probably went only about 10 feet, and while it was moving I had to go along with it by walking alongside of it. The resulting injury was a badly bruised arm (T. 2414–2416).

R. S. RASMUSSEN, on cross-examination, testified:

This accident could have happened with the manual reverse, and by that I mean that if the fireman had not given me the warning with the reversing gear, possibly if I had been further down on the

radius rod, I probably would have gotten the same thing. There is not much clearance (T. 2416–2418).

C. A. JEFFERS resumed the witness stand and upon direct examination testified as follows:

Before testifying to the various instances to which I have referred, where engines moved and reversed themselves, I refreshed my recollection. I carry notebooks and make notes of happenings in connection with my work. When I learned I was coming here, I looked over my notes and referred to them in giving my testimony.

I have observed creeping on reverse gears on occasions other than those to which I have heretofore referred. I have observed it a great many time, and probably the only note I have on it is, "Reverse gear creeping." At the end of my day's work after I have made notations of trips or the distances I have ridden on engines, I write down, "reserve gear creeping." And there have been numerous times that I have observed gears creeping and heard the Alco moving in roundhouses of which I have no record. The instances I mentioned were ones where I was present and could remember what went on.

682 I recall one time when the engineer unlatched the reverse lever to nick it and it went down with him, but he got hold of it and soon had it under control. He eased off on the throttle and again put in into the working notch. I do not recall at this time any other occasions of that kind. I checked this question of clearance in my daily work and I have not found any engines but which have proper clearances around the hand reverse lever. There has been sufficient clearance on all engines I have inspected and those engines I have handled and tried both ways.

It is much easier to find defects in the hand operated reverse gear than in the power reverse gear as there are fewer places to look for trouble, whereas there are more complications and more things that can not be seen in the case of the power reverse gear, from the source of supply where the air is cut in to the power gear to its operation all the way to the valve. Most of the hand reverse, including the reach rod, can be seen. However, on some hand reverse the connection at the bottom can not readily be seen, but one can always see it with a good light and tell whether the connection is there. On most locomotives that connection is below the runningboard and can be seen from the cab by looking down the side of the reverse lever. On quite a number of locomotives it can be seen from the ground although there may be some where it can not. They are covered over with a wind sheath to protect them from storms. This sheath slides so that it can be moved and the connection inspected. Any part of the sheath can be removed without a great deal of trouble, and there is also a peep-hole on a number of the locomotives, through which the connection can be seen.

683 The point of cut-off of a locomotive is controlled better with a hand gear because the connections are solid and there are fewer of them, while the power reverse gear depends upon compressed air. To illustrate the difference between the way the two would hold, the comparison is made between a solid bolt and a football or compressed air in anything for holding resistance. There are more connections between the reverse lever on the power reverse valves, more parts to wear, which gives an opportunity for more lost motion with a power reverse than with a hand reverse. The ratio of lost motion on a power reverse is greater than on a hand reverse for the reason that the notch on the power gear means more than a notch on a hand lever. Of course, the size of the notches on each one would have a lot to do with that. At present I think there are fine-tooth quadrants on the power gears, while there was a time when the notches were larger. With the same size notches, or fine-tooth quadrants, I think the ratio on the power gear would be greater, that it would move the valves farther than a notch on the hand lever. Lost motion on the power reverse gear is more noticeable on (T. 2418–2426) account of the different parts and of the movement. Because of lost motion on the power gear there is not the control that is found with the hand gear, and this is on account of the mechanism of the power gear, the opening and closing of the operating valve. The valve is made to open and close, but is also made to control the point of cut-off, which it does not do as well in the case of the power gear as it does in the case of the hand gear, because of this lost motion.

I have observed the efforts made toward maintaining the power gear and have made suggestions relative to such maintenance. I have followed up the work in the roundhouse and had the work done in a manner which I thought would get the best results. In the territory over which I have jurisdiction, we have power reverses

684 of every type used by the Chicago and North Western. I have not had occasion to follow up maintenance other than within my territory, consisting of Iowa and Illinois. My interest in the maintenance work of the power reverse is due to the fact that it concerns to a great extent the amount of fuel used.

I have ridden engines with representatives of the manufacturers of these power reverse gears and have gone with them to the roundhouse and made suggestions to them for changes or betterments. This applies to the Barco gear, that is, that part of it. I have met these representatives more than once and followed up different engines. The purpose of these representatives being on the engines was to do something to stop the creeping. I discuss the question with them and hold conferences with them. In attempts to overcome creeping tendencies of these gears, the Chicago and North Western have changed parts and added parts. The C ring in the Barco gear has been changed and the close fitting bushing has been added to the bottom of the worm. These changes were made as a result of suggestions by me and the mechanic. The mechanic suggested it

to me and I told him to try it and I would follow it up and see what it did, and that we would call in the service man of the Barco Company and show it to him; this was afterward done and the result was a change by the representative. He did not do the same thing we did, and we did not think he got as good results. (A C ring was introduced in evidence and marked for identification as defendants' exhibit no. 26, Witness Jeffers. Another C ring was also introduced in evidence and marked for identification as defendants' exhibit no. 27, Witness Jeffers.) The ring identified as exhibit no. 26 came from a box of used rings in the roundhouse at Boone, Iowa, and was from a Barco reverse gear, type B–3, and is a type of ring with which the gear came equipped. We put a coil spring in that ring
685 to hold it close to the piston, in this groove around the ring. Prior to putting that spring in they would leak and blow air by this gasket down through the worm, and contributed to the creeping of the gear. My experience with them has been from the time we first had the gear until a year this last winter, at which time we experimented with taking up the leak. I should say January 1930 is when we did some experimenting toward stopping this leak and remedying the creeping of the gear. This gasket is used at the bottom of the worm, the bottom joint on the worm, or I should say the joint at the bottom of the worm. Its purpose is to make a tight joint and keep the air from blowing by. By putting a spring in that groove, it held the gasket in place and it held still better when we made a close fitting bushing and put it at the bottom of the pinion so there would be very little play at that point and thus kept the gear from jumping. These gaskets go in upside down. If they went in the other way, the gasket would help hold the gasket tight to the piston. But they have to go in with the grooves down in order for the ring which sets on top of them to have a good surface on which to rest. The groove is on the opposite side of the gasket from the air pressure. I could not say what the life of the rings were in actual operation. They were short-lived, but I can not tell definitely the life or the average life. They lasted longer after putting in the spring to hold them in place. It stopped the leak.

Referring to the ring marked for identification as exhibit no. 27, that is the improved ring filled with soft packing in the groove instead of the spring and is the one put out by the manufacturers. However, I cannot state definitely when they started fur-
686 nishing these rings. They tried them after they saw what we had. This ring holds better than the old one and has improved the performance of the gear but not made it 100 percent by any means. There are other points where the air leaks by besides these points protected by the gaskets and these particular kinds of gaskets. But this was the worst leak we had to contend with on the Barco gear. There is quite often a leak at the top of the sector gear. The use of these gaskets has stopped some of the creeping. I do not know of any experimental work in connection with the other two types of gear in use in my territory. There has

been no improvement in the performance of the Alco and Ragonett types in my territory during recent years, and the creeping of which I have spoken applies to these types. I have no personal knowledge of any efforts being (T. 2426–2440) made by the manufacturers of the Ragonett and Alco to overcome creeping, nor do I have any personal knowledge of anything that has been done in this connection by our own mechanical forces. The mechanical forces of the Northwestern have made an honest effort to properly maintain the power reverse gear of all classes in use on the Northwestern and a lot of money has been spent in that way.

I know the kind of work and what repairs have been made in connection with the power reverse gears. I know lost motion has been taken up in connecting parts and rotary valves have been lapped, and also know that leaks have been taken care of and stopped. These repairs have not resulted in any permanent effect, that is, creeping was not stopped for any length time, although it did stop it to start with. The creeping would stay stopped a trip, sometimes several trips.

I have used the hand lever a good many times to assist in controlling the speed of trains and stopping engines, particularly in hill and grade work. On a 1 to 2 percent grade near
687 Deadwood, S.Dak., I often used the hand lever when I was using the old 92 brake valve in the absence of sufficient braking power from the air brakes. I put the engine in reverse and worked steam and two streams of sand. I did not turn the wheels in the opposite direction but just kept them from turning in the direction in which I was going. They would still turn in that direction until I got a working back pressure. This makes a wonderful brake. You get them in reverse motion on two streams of sand and with not enough air in the air brake cylinder to slide the wheels, they make a wonderful brake and a very dependable one. I did not experience any difficulty in handling them in that way. I have not done this on larger types of engines. As to whether I could do this with an engine equipped with power reverse, there is more probability of the power reverse not holding the valve gear where you want it, and the power gear is more liable to give you a false indication in the cab as to where the valve motion is. In braking with the hand lever, the position in which I placed it depended upon the grade conditions and how much braking was wanted, that is, whether I just wanted to hold the light engine or hold the train. I did that in order to hold the light engine, as up around Deadwood, S.Dak., there are some very steep grades. Track room in that vicinity was very limited and no more track was built than was necessary. In the absence of air on the locomotive, I could not do this with the power reverse gear.

In my experience and from my observation, the use of the hand lever or the operation of it by the engineman has not interfered in any way with his ability to keep a look-out or to take signals.

The hand-operated reverse is more economical and more efficient than the power reverse gears when they creep.

688 From the standpoint of safety I would say that the hand lever is better than the power reverse gear, that is, the hand lever is safer than a creeping power reverse gear. I don't think there is any difference when the power reverse gear performs as it should (T. 2440–2446).

C. A. JEFFERS, on cross examination, testified:

In giving my opinion about the safety of manual reverse, I took into consideration the fact that certain parts of its valve mechanism might break, and if the counter-balance spring should break while attempting to hook up or drop down an engine equipped with manual reverse, I still would think the hand lever as safe as a creeping power reverse.

I have never seen an engineman injured in handling a creeping power reverse gear while he was in the cab. My opinion is that if the counter-balance spring broke on a manually operated lever and the engineer stayed in the clear, he would be perfectly safe. If he did not stay in the clear, that would be because of his poor judgment and hard luck, there being a possibility that he might get hurt if he got in the way of the moving lever. And again, he might not get hurt as that would all depend upon how fast it moved and the force. It is possible that it could move with sufficient force to injure him. In my judgment there is a possibility of danger if an engineer does not stay out of the way of a manual lever. Referring to the two cases where the lever went to the corner because of broken parts, in one case the bolt that holds the latch to the lever was broken and in the other case there was loosened the adjusting set screws of the box arrangement latch for the lever, and the result in both cases was that the latch became unlatched and lever went down. The reason the lever did not go in the opposite direction is that it is more apt to go in the direction

689 in which the engine is moving, and which is because of the speed of the engine and the working of the valve gear in that direction; the speed of the engine and the working of the valve gear makes a pull on the lever in the direction in which the engine is going. With power reverse you do not notice that pull from the valve motion on the operating lever in the cab, the reason being that there is an air cushion on each side of the power reverse gear piston which controls the movement when the power reverse gear is operating properly, and that air cushion acts as a shock absorber to any pull there may be from the valve parts. The power reverse has a connection between the mechanical parts from the valve motion to the operating lever, and that connection is between the arm which controls the rod to the tumbling shaft and the rod connection to the lever. I have been speaking of the Alco and Barco gears. The only action of the lever in the cab on a power-equipped engine is to change the valve that admits air into the air cylinder, while

with the manual reverse the hand-operated bar in the cab is directly connected with the valve motion. When I referred to the direction of the parts of the power reverse gear to the hand-operated lever in the cab, I did not refer to the floating lever but to the lever that connects to the floating lever and the connection to the reach rod. The lever to which I refer cannot move unless the piston moves if it is working properly. There is a connection there and while it is not direct it is there just the same between the valve gear and the reach rod. There is a connection there although it is not direct (T. 2446–2451).

690 Instances have occurred with power reverse equipped engines where the engine reversed itself and the lever in the cab remained stationary. This happens due to the fact that when the valve gear creeps and the rotary valve operates, opening and closing the ports and exhausting the air to and from each end of the cylinder, the force is such that the engine can be reversed with the arrangement of the connection between the reach rod and the valve gear through the floating lever and the connections to the valve. When the engine reverses itself, the floating lever has to move but that does not produce an effect upon the operating lever in the cab, any more than there is a surging at that point all of the time, as though it was trying to pull itself off the boiler head. I have noticed it do that and have watched it but have never seen it pull off the boiler.

In my notebook I have memoranda of ridings and often of work that I have reported and briefs made as to certain things that happen on the road, things that I find in my travel and in my work Dates of such occurrences are shown. In that book I keep items other than power reverse. I have that book with me. I examine that book for instances of where there were defects in the manually operated reversing mechanism. I went clear through the book for any defects I might find in maintaining the desired points of cut-off.

It is more difficult to observe the defects in power reverse mechanism than manual reverse. It is possible for an engineer in making his preliminary inspection before going out or while he is on the road, to observe all the defects which may exist in the manual reverse. He could not see whether the metal in the reach rod was crystallized and he could not see inside the valve chamber. Dry valves, broken rings, or any obstruction in the valve chamber

691 would make the lever handle differently. Different conditions make it handle differently and it is possible that it would handle harder. However that depends upon the kind of valve and how well it is balanced. It is possible that with any valve where the ring is broken, the lever will handle harder. I have had broken rings and would not know it until after I had looked inside the cylinder. I have had levers that handle hard; however, that depends upon whether the broken parts interfere. In making his inspection an engineer does not have to remove the wind sheath around the quadrant. He can slide it and look in there. Engineers have not

been instructed to do that. A lot of them do this anyway, that is, if they have an occasion to look at it. In other words, if they have any reason to think there might be a loose connection at the bottom of the reverse lever or any defect of any kind, they are very apt to slide this sheath and look for it. Often they can feel a loose connection, and I have had those experiences.

Lost motion in the bushings along the valve motion and lost motion in the parts of the manually operated reversing gear may make the lever in the cab chatter and rattle a little in the quadrant, especially if the lever is hooked up too high for economical service. Whether it is hooked up too high depends upon the amount of lost motion with which you have to contend. The idea is to work the lever down far enough so she will do her best work with worn parts. I have observed in working the lever in the proper notch that sometimes it will have a chattering sound, but there is a movement of the lever at all times in running. This movement produces a wearing of the notches in the quadrant and the latch teeth and which would contribute to making it easy for the lever to get out and go down.

692 If you have lost motion in the valve motion bushings on an engine equipped with power reverse, you will not be so apt to have any motion in the operating lever in the cab, due to the cushioning effect in the air reverse; but you do get a little, which is a chattering of the valve, and this is particularly noticeable on an engine when the valve gets dry or the engine carries water over into the cylinders. You can pretty well tell by the action of the power reverse lever in the cab, together with the performance of the engine and the way she responds, as to whether the engine is getting dry or has water going into the cylinders. At the present time we are using the Alco type G power reverse, and I don't know that I can tell all the differences between the various types of valve gear movement. This type G is the latest Alco gear that I have had experience with. It has been on the H engines the past year and a half. (At this point a document was received in evidence marked "Exhibit No. 28", Witness Jeffers, which showed the different types of gears on the different classes of engines and the weights on drivers. Documents previously marked for identification as exhibits 26 and 27 were received in evidence.)

The type G Alco gear is on 35 mountain type engines and also on a number of other engines that have been equipped within the last few years. The mountain type is class H 4–8–4. On numerous occasions I have found defective packing rings on the Barco gear—the C ring—but I cannot state definitely the number. However, it was to such an extent that it concerned the fuel department very much, and we wanted to do something to help out and stop it. About a dozen times during the last months I have been in four different shops to observe what was going on with respect to repairing the power reverse. I could not tell (T. 2452–2461) how many engines

were in those shops, but each shop had some on which they
693 were working on the gears. Possibly some of this work was in accordance with a periodical examination, but most of the work was the result of reports from the enginemen of the reverse gear creeping. I could not tell definitely how many of these engines had work reports on them, but my experience is that invariably I will find two or three reports of gear creeping in any one of the four points when I look over the work reports in the morning. There might be others that had come in and gone, and I would not see the reports on them. But an average is two or three work reports on creeping power reverse gear. I would say that my experience has been that, in riding engines, 20 percent of the trips has been with creeping reverse gears. Reports were made on this trouble when it was not taken care of before reaching a terminal, as sometimes the trouble can be taken care of before the terminal is reached and thereby save fuel and worry. This would be done by tightening the piston gland and stopping the leak in the Alco. I could not give any percentage setting forth the number of adjustments made before the engine reached the terminal. This 20 percent figure I have referred to is a safe one to cover the past five years, and I think I have made the percentage low. I could not give you any estimate as to the number of times power reverse gears were reported for creeping on the occasions I have ridden engines, but I do know it has been numerous. During the last three months I have ridden engines possibly three or four times where the power reverse gear was reported as creeping. I do not know how many trips I have made during that time or how many engines I have ridden. I think I have ridden as many as 10 engines during the last month, but not as many as 20.

Referring to the occasions I have mentioned where the engines
have "walked off," the first one was engine no. 2213, and
694 the brake was not set on that engine. The roundhouse force and foreman are not instructed to set brakes on engines in the roundhouse. Engine 3126, the one which went into the pit (T. 2461–2466), did not have the brake set. That is the engine which climbed over the blocks. It is not possible to keep the brakes set on an engine in the house and do the work that has to be done around it. There is a possibility that the steam which moved these locomotives came from the superheater units, and there is a possibility that the throttle was not closed tightly. There is also a possibility that it was due to some sediment in the throttle valve. There could be enough steam developed in the superheater units to move the locomotive. As to how long these engines had been standing in the roundhouse, I am unable to state. It might have been one hour, or three or four, or it might have been more than that. But they were all under fire. I did not observe the fire in those engines as I did not open the fire box. There might have been quite a hot fire in one of them. However, the steam pressure in the boiler was up to the maximum. With

the steam up close to the maximum pressure, water would form in the superheater unit because it gets in there by being carried over from the boiler in the working of the engine and is there by condensation. If an engine has been cold and fired up, there might be water in there. Even when the engine has been cold there could be some in there by reason of condensation, with the valves shut off. There could be some carried over with the last exhaust of the engine coming into the roundhouse, if she had not been there very long, due to the boiler being too full of water. Enough steam can be generated in the superheater units to move the engine, from the water that is in there. One exhaust might clear the units or it might not.
695 It would depend upon the question of whether there is condensation in the units, the amount of steam that is generated from it, and whether it would receive water from any leakage (T. 2466–2471).

With reference to the occasion where the drawbar was pulled out and the power reverse gear on the engine was creeping, that is an uncommon thing, although we have that happen once in a while, and it has happened where the engine was equipped with a manual reverse.

When using the manually operated lever as a brake, the engine is thrown into reverse motion over center, which puts pressure against the valves, against the cylinder pistons. I consider that a very efficient brake although it depends upon the service. It is a safe practice for certain types of locomotives and air-brake appliances. There is a difference between that and the situation that results from power reverse gears going into back motion when running, in that with the old 92 brake valve there was no pressure maintenance feature for maintaining driver brake cylinder pressure like there is on "ET" equipment. There is a difference in the handling of the train, as between putting it into reverse motion for braking purposes, and where the power reverse gear goes into reverse motion, in that when you put the hand lever in reverse motion it stays put and your engine will lay good and hard back against the train, while the power reverse gear that reverses itself may go forward and back any number of times. Such a gear may be in reverse motion or it may go ahead clear to forward motion. My experience is that the power gear does not stay anchored like a hand-operated lever. I have had experience where the power reverse gear reversed itself and went back and forward between front motion and full back motion, and that was with engine 3002. In that case it did that three times in a distance of 30 miles, and
696 each time it went into reverse motion it went back and forth.

This all happened between Clinton and Sterling. On this occasion I could not say how many times it went back and forth, although it did so numerous times. There was no breakage that could be detected, and no damage done to the train, and no one was hurt. In fact on none of those occasions where I have observed

the engine "walking off" has anyone been injured. That engine 3002 was equipped with an Alco gear. I do not recall having had any (T. 2471–2475) experience with a Barco gear reversing and going back and forth, although it is possible for it to do so. It would not go back and forth very rapidly, and I don't think it would do so with each revolution of the wheels on the engine. It could do it without moving the hand lever, but I never saw it go back and forth. On the occasion with engine 3002, equipped with the Alco gear of the latest type, when it reversed itself the operating lever acted as though it was going to pull the whole works off the boiler head, but it did not move in the quadrant. That engine went into reverse in forward and backward motion so rapidly you could not keep track of it. By that I mean it reversed the valve gear forward and backward, thus putting a terrific strain on the wheels. This might or might not have an effect on the revolution of the wheels.

If steam is trapped in the cylinders, it sets up a terrific strain on all parts of the gear, the wheels included. When a locomotive reverses itself of its own volition, it would be hard to say whether or not the direction of the revolutions of the wheels is changed. When an engine reverses itself, it does not always reverse the direction of the motion of the wheels. You can work steam, and then momentum of the train will turn the wheels in the other direction.

697 I have had experience with the Alco power reverse gears for the past six or seven years, and there have been and still are changes being made in that gear. There has been some improvement by virtue of the changes, but the trouble has not been entirely cured. I do not say that there has been no improvement (T. 2475–2482).

The amount of excess fuel used by virtue of putting on power reverse depends upon the performance of the power gear. I have found different percentages, as much as 20 percent some times. It all depends upon the amount of creeping, and it has happened that a locomotive with creeping gears burned 20 percent more coal. I would not, however, say that is an average—it might be more or less. I started to observe the excess use of coal when I first started riding engines equipped with power gears. I have no records of any predecessor in my department to show the amount of the excess fuel due to creeping, although I know the subject was up prior to my time, because I have heard it discussed by other supervisors in the fuel department, men who were supervisors before my time, and road foremen of engines and other mechanical officers. I am not sure as to who determines whether engines will have power reverse gear or not. I have made reports to my superior officer, the general fuel supervisor, of the waste of fuel on engines equipped with power reverse. These reports would be in writing and verbally. I would have to look over the files to tell when I made a report in writing, and these files are in Chicago in the fuel supervisor's offices.

I do not know whether there is an increasing number of engines being equipped with power reverse on the North Western. There have been power gears applied since I have become fuel supervisor, and that has been in gradually increasing numbers (T. 2482–2488).

698 C. A. JEFFERS, on redirect examination, testified:

The fuel department is a branch of the mechanical department and reports to the chief mechanical officer. My experience has been that with the latest type Alco gear there has been no improvement, with respect to creeping, over the earlier types. With respect to the vibration of the lever in the cab due to dry valves in the case of a hand operated engine that does not occur before the effect of the dry valves is noticeable by the exhaust. You will notice the performance of the engine at the stack before the lever shows any signs of it; you will notice the way the engine responds to the work she has to do and what is going on in the working of the engine (T. 2488–2490).

J. R. FIELDS, a locomotive engineer for the Illinois Central, residing at Memphis, Tenn., weighing 182 pounds, age 56 years, testified:

I was employed in engine capacity by the Illinois Central in 1891. I was promoted to engineer in 1896, since which time I have been continuously and regularly employed by the Illinois Central in switch engine service. In switching service I have used engines weighing 121,450, 66,000, and 117,800 pounds on drivers, equipped with manual reverse gears. The clearance in the cab with respect to these engines has been very satisfactory and I have always found it sufficient for operation of the hand reverse lever. My present physical condition is very good. I have never been strained or overtaxed, or become exhausted by reason of the operation of the manual reverse gear, nor have I been injured thereby, nor while I was in the cab has anyone been injured.

I have never found the manual gear hard to operate, and it has never been necessary for me to call upon the fireman or another person to aid in throwing the manual reverse gear. I
699 sometimes use one hand and sometimes two to throw the latch up, which depends on how I feel. I have been in switching service for approximately 40 years and do not recall any difficulty in receiving signals given by members of the crew. I have had no difficulty obtaining signals from the rear. I have never had any experience with respect to the lever going to the front or back corner of the cab without my putting it there, nor have I had any experience with the lever jerking or pulling away from me after I had unlatched it, neither have I had any experience with respect to the lever jumping out of the quadrant. In answer to the question, "On these engines are there any foot rests of any kind?" the witness replied, "I have a platform about 8 by 10, 8 feet wide and 10 inches high at each end. The seat is up this way, and my feet rest on those,

and when I turn around I have got them up there [indicating]. When I straddle the seat, I have got one on each end."

I have had about three years' experience in the handling of power reverse equipped locomotives, and have never been injured in any way in the operation of them. (For the benefit of the record, it was developed that the power reverse equipped locomotive weighed 169,000 pounds on the drivers.) I operated this engine in switching service.

Since I have been running an engine equipped with the hand gear, I have picked up about 40 pounds in weight, and I prefer a hand gear engine on account of my health, because when I leave work I feel well enough to go to a party, a dance, or anything I want to; while when handling one of the power reverse engines on a switch run, I would be tired that night and feel like staying at home. I would feel much more tired with a power reverse than with a hand reverse. I now weigh 182 pounds, and I weighed
700 142 pounds when I was on a power reverse. The power reverse engine I am referring to is one in passenger service, a coach engine handling passenger trains.

With the hand reverse I have done industrial work and at the present time I am on what is known as an employees' train, making one trip every hour, and I have been on that job about 12 or 13 years.

There was Ragonett equipment on the power reverse engine. At the present time, in addition to operating this employees' train I do some yard switching. I have to pick up cars and set them out twice a day. I began operating engines equipped with power reverse in 1912 and 1913 and continued to do so for about three or four years, since which time I have been operating the manual reverse engine (T. 2491–2499).

J. R. Fields, on cross-examination, testified:

When I started running power reverse engines I weighed about 142 pounds, and that had been my weight for some time prior thereto. It has been in recent years that I picked up the extra pounds. I now weigh 182. I am under no strain whatever in handling the manual engines. I do not say that there is no effort necessary to throw over the lever, but I do say there is no strain, nothing to bother me. I have never injured myself with the manual lever. There is very little difference in the amount of effort it takes to pull back the lever on power reverse and the amount it takes to throw the lever on the manual reverse, that is on the small engines. Of course, on the larger engines it would be different. On the engines which I am running at the present time, I would not give that for the difference [snapping the fingers].

I have spent about one-half of my time on 121,000-pound engines, and the other half on 66,000-pound engines, and it requires
701 about the same amount of strength to throw over either of them. I prefer the manually operated engine, because of the

exercise I get and also because I can handle them. In other words, I did not get enough exercise on the power reverse engines. On a manually operated engine I feel well all the time, and with the power reverse gear my legs get stiff and do not feel well. I get tired resting. On the power reverse engines my legs get stiff because I do not use them, and it is the same thing with my arms (T. 2499–2502).

W. J. DOOLITTLE, an engineer employed by the Illinois Central Railroad Company, residing at Gulfport, Miss., weight 157 pounds, age 53 years, testified:

I was first employed in engine service in 1899, and was promoted to engineer in 1902. Since 1899 I have been continuously and regularly employed in engine service, operating in local freight, through freight, and passenger. My present assignment is a passenger run between Mineola and Columbia, Miss., 114 miles round trip. I am at present operating a 60-ton locomotive, but have operated them up to 90 tons. The locomotive I am operating at present is equipped with manual reverse gear, whereas the 90-ton locomotive was equipped with power reverse gear.

I have found plenty of clearance in the cab on the locomotive equipped with the manual reverse gear. I have never been injured in the operation of a power reverse, or been in the cab when anyone else was injured. My present physical condition is perfect. I have never at any time strained, overtaxed, or exhausted myself in the operation of a manual reverse gear. Since 1899 I have operated manual gears 50 percent and power reverse gears 50 percent of the time. At the end of a day's work on a manually equipped
702 engine I feel all right, and I feel the same way after working with a power reverse gear. That is, I feel just about the same after operating a small engine with the hand gear as I do with the large engine with the power gear. I have never been injured or seen anyone injured by the power reverse gear.

I have never found the manual reverse gear difficult to operate, nor have I had any difficulty in hooking up the engine with one hand while running. On the manually equipped engine I have had the lever go to the corner with me, that is, it slipped loose from me, the cause possibly being greasy gloves. With worn notches they have crawled out of the quadrant, and when the lever has done that I have reported it. When this happened there was no occasion for me to be injured as long as I exercised precautions and stayed out of the way. The hand-reverse equipped engines have a foot rest. I use one hand in operating the manual lever and have always been able to maintain a definite and positive cut-off with that type lever without any difficulty. I have never had any difficulty with a power reverse gear creeping.

While operating an engine equipped with a hand reverse I have never experienced any difficulty in keeping a proper look-out and

observing signals, either the stationary signals or those given by employees.

I have never had any experience with power reverse gears pumping (T. 2502–2508).

S. J. BUCKNER, a locomotive engineer employed by the Illinois Central, residing at Memphis, Tenn., weighing about 160 pounds, age 54 years, testified:

I was first employed in engine service on October 28, 1904,
703 and promoted to engineer on August 15, 1907. Since 1904 I have practically been continuously and regularly employed as an engineer and fireman in switching service. I have operated engines weighing 142,000, 99,000, and 178,650 pounds on drivers. Then I ran a large locomotive which we could not ascertain the weight of. I have also operated engines with the following weights: 218,300, 169,000, 118,900, 66,300, 121,450, and 117,800 pounds on drivers. All except the engine with no known weight and the 169,000- and 218,300-pound engines were equipped with hand reverse. On engines equipped with the manual reverse I have always found sufficient clearance in the cab, there being about four inches between the lever and my body. My present physical condition is good. I have never, in the operation of engines equipped with manual reverse gears, strained, overtaxed or exhausted myself, nor have I been injured in the operation of this gear, or been in the engine when anyone else was injured. I have never had any difficulty in moving the manual reverse lever from one corner to the other, except while breaking in engines. I have had little experience breaking in engines. After breaking in an engine the manual reverse gear is in a condition where it can be handled. The longest time it took me to break in an engine was two days. We are allowed that time to break in any regularly assigned engine. I have broken in engines equipped with both manual-and-power reverse. The difficulties are about the same with each.

I have not found it any more difficult to get signals on a hand reverse engine than on one equipped with a power reverse.

I have never had the lever pull away from me after having unlatched it. On only one occasion did I ever experience the lever jumping out of the quadrant, and that time it went slowly to the corner in forward motion, and there was no opportunity for
me to be injured by its action. These manually reversed
704 engines have a foot rest on them which I use to rest my feet.

With a switch engine we don't worry about the cut-off, although we can maintain a positive cut-off with a manual engine.

In the operation of the power reverse gears I had had some difficulty with them creeping, but that condition of the engine did not cause me any additional mental strain. It just caused additional labor in trying to keep it at the proper point of cut-off.

About 1905 or 1906 I avoided an accident while working on the north end of the old shop track. I saw an engine backing out of the

roundhouse. I jumped off my engine and jumped on it. I threw the brake valve in emergency, but there was no air. I then threw the reverse lever into forward motion and gave her enough steam to stop. The engine was equipped with a manual reverse lever. Had it been equipped with a power reverse gear and there had been no air, it would not have been possible for me to have stopped the engine (T. 2508–2517).

Up to March 10, I was operating an engine equipped with a power reverse gear and using it around a cottonseed crushing plant. The machinery around this plant made so much noise that I could not hear the engine reverse, and if the engine would not reverse I had to sight the side of the cab and the building to see which way the engine was moving when I gave her steam. The engine did that two or three times and no one fixed it. I told the mechanics and they said they did not know what was the matter. I ran this engine for a period of three months and took my present job because I was mentally and physically tired of running that engine. I think I reported that engine every time I made out a work report.

I had another dangerous condition with an engine equipped with a power reverse gear, and that was about four years ago.
705 I was standing on the combination lever, holding to the radius rod in order to oil the top end of the link. I asked the machinist to pack the valve in the cab and while I was standing on the lever he reversed the engine to get the lever out of the way and threw me four or five feet. I stumbled against another engine but was not injured.

I have observed power reverse engines in roundhouses where the situation was such as might have resulted in damage or injury to someone. By this I mean I have seen air cut off the reversing gear for packing in order to pack the piston or oil it. I have seen the air cut on and the valve gear or radius rod and piston go up inside. I have seen it make 6, 8, or 10 strokes up and down the full length of the link, and anyone working around the engine would be liable to be hit by the radius rod cross head or the connecting arm from the reach rod to the tumbling shaft (T. 2517–2522).

H. R. Spikes, a locomotive engineer employed by the Illinois Central, residing at Mendenhall, Miss., weight 160 pounds, age 56 years, testified:

I was first employed in engine service in 1898 and promoted to engineer in 1902. Since 1898 I have been continuously and regularly employed in freight and passenger service, from 1902 to 1907 in freight and from 1907 to the present time in passenger. The heaviest locomotive I have operated weighed 180,000 pounds on drivers, whereas the smallest one weighed 77,000 pounds. I have never operated a locomotive equipped with power reverse. My present run is 116 miles a day, on which I use a locomotive weighing 77,000 pounds. I have never had any difficulty with the clearance on locomotives as it has always been sufficient.

706 My present physical condition is good and during my years of operating manual reverse gears I have never strained, overtaxed, or exhausted myself; neither have I been injured nor have I seen anyone else injured as a result of operation of such gears.

With the engine I am now operating, I unlatch the lever with one hand and at times I put my other hand on top of it in order to put it in the position I want it, while sometimes I pull it up with one hand. I have never had any difficulty in operating the lever from one position to another, and have never had any difficulty in keeping a proper look-out and observing signals. It has never been necessary for the fireman to aid me in throwing the hand lever. I never had any particular difficulty with hooking up an engine while running. I have had it unlatched but that did not bother me as it would go down in the corner and stay, and I have had the lever jump out of quadrant and go to the corner. On both of these occasions I was sitting on the seatbox, but there was no danger of me being injured as I was not going to let that happen. The cause of the lever jumping out of the quadrant was the fact that it had become worn. I reported it and it was remedied. These engines are equipped with foot rests, which I use to keep my feet on. I have my feet on it when I set the engine back, and I do not use it for any other purpose. I have never experienced any difficulty in maintaining a definite and positive cut-off with the manual reverse gear (T. 2522–2527).

H. R. SPIKES, on cross-examination, testified:

The 180,000-pound engines are equipped with slide valve and Walscheart link motion, while the 77,000-pound engines have a slide valve and a Stevenson gear. The larger of these engines is,
707 of course, somewhat harder to handle, there being more weight and friction. I operated the 77,000-pound engines from 1902 to 1907 in freight service.

When, in operating one of the 180,000-pound engines, I wanted to hook it up a notch or two, I would probably use both hands. On those engines there is a pin coming out which connects with the quadrant and upon which I would put my foot for convenience. Those engines were not hard to handle. When I took both hands to hook up I would unlatch with my left hand, and throw my right hand over the top of the lever sticking up above the latch in order to pull it back. You could not detect that I would throw very much purchase on my legs while hooking up. This pin which connected with the quadrant was put there for the purpose of putting your feet on it. I don't know whether it was to serve the purpose of a brace or for the purpose of relaxation. I use it to keep my left foot on when riding the engine. Of course, when I was switching I would drop the seat and stand up to perform that service. In reversing the engine from back motion to forward motion, I would have to use that pin, but there are times when I would go from forward motion to back motion without putting my foot against it. I do not

know that it is harder to throw an engine from the forward to the back motion than the other way.

When I say that when the lever became unlatched I would not permit myself to be injured, I mean that I would not try to hold it back even if I had my hand on it. I would turn it loose and let it go, because it might accidentally jerk me as it went down. It would go down with enough force to jerk me if I kept hold of it. The dogs on the levers wear as there is a certain amount of play there, and that wear is generally on the front of the dogs because the engine is in forward motion most of the time and that gives a forward pull on the lever (T. 2527–2531).

708 A. L. SAWYERS, a fireman employed by the Illinois Central, residing at Chicago, Ill., age 30 years, testified:

I was first employed in engine capacity on June 15, 1923, and have worked on all classes of service on the Illinois division. During my employment I have had occasion to operate the reverse levers on many classes of engines. I have operated hand-reverse gears as well as the Ragonett and Precision. I have never been injured by reason of the operation of the gears, but I have seen a person so injured and that was on February 29, 1928, near Ashkum, Ill., in passenger service. The engine in use was no. 2435 of the 2400 mountain type class, weighing 247,000 pounds on drivers, and equipped with the Precision gear. At the time of the accident I was in the cab reversing the engine. The engineer was on the ground at the left side of the engine. A hot box had developed on the left front drive of the engine. The engineer decided to stop and put a block under the spring saddle to take the weight off of the driving box. After stopping, the traveling engineer, who was on the train, came up, as well as several others. After putting a wedge under one driver, the traveling engineer came up and told me to set the straight air and reverse the engine. The straight air was already set, but I reversed the engine into backward motion. The engine was on center. I went back to fixing my fire and someone else came up on the side of the cab and called to me to reverse the engine. It was dark and I did not see who it was. I wound the reversing gear toward forward motion and heard those on the ground halloo and I immediately stopped. The engineer at that time had his arm over the guide under the radius rod, trying to get a wedge under the spring saddle. The radius rod came down on his arm a little above the wrist and crushed it very badly. I don't know how many
709 turns of the wheel I had made, but the indicator showed about halfway between center and full forward motion. As soon as I heard the yell I stopped, went over and looked out of the window on the left side. At the speed I was turning the wheel I judge another full turn and a half of the wheel would have about completed the full stroke.

I have had experience with the reversing of engines equipped with the Ragonett type of gear, and that type moves quite a bit faster

than the Precision type. There is not much difference in the time it takes to throw the manual reverse gear and the Ragonett, but there is a difference in time between the hand reverse and the Precision, as the last mentioned is much slower.

I have on many occasions moved the hand reverse levers from one position to the other, and the feel in moving the lever has not always been the same. I can recall one or two occasions when this happened while we had the old steam engines in suburban service. Several times when the weather was cold and there was a lot of snow and sleet, it was almost impossible to reverse an engine which had been standing out by itself overnight, because of snow and ice in the reversing gear. If there is any obstruction or anything that might interfere with the free movement of the hand reverse gear, it could ordinarily be felt. But from my experience in the operation of power reverse gears, I have never been able to detect or had a feeling of any obstruction in the movement of the gears.

I have had engine no. 2436 since February 29, 1928, on a number of trips and it is still equipped with the Precision gear (T. 2531–2539.)

710 H. L. WILLIAMS, road foreman of engines for the Chicago and North Western, residing at Clinton, Iowa, age 48 years, testified:

I am a road foreman of engines on the Iowa division, which extends 202 miles, from Clinton to Boone. Under my jurisdiction I also have branch lines to Anamosa and Tifton, and also a 42-mile line from Des Moines to Jewell Junction.

I weigh 217 pounds and am 6 feet 1 inch tall. I started to work for the North Western as a fireman in 1907, and was promoted to engineer in 1911. I was traveling fireman from 1911 to 1918 and was promoted to road foreman in 1918 and still hold that position, which is the supervision of engines, enginemen, and roundhouses. My position requires that I ride on engines and observe the engineers' handling of them, as well as the performance of the engines. This takes about 20 days a month. The position of traveling fireman required the riding of engines to about the same extent. In riding engines, when I find a power reverse gear creeping, I undertake to discover what is wrong with it; and if I cannot, I have the engineman report it, that is, if I do not report it myself. And, upon arrival at the roundhouse, I go to the foreman and often get the man who does the work and follow up the work to see if the difficulty can be overcome. Then if I have the opportunity, I follow the engine out and see if the condition has been remedied. That sort of supervision extends to anything that may be wrong with an engine.

There are things a lot worse than creeping, such as lunging. I have seen cases where the engine went into back motion, and others where the engines could not be hooked up anywhere near the desired cut-off. I have been on an engine when the lugs that hold the operating lever which moves the valve, would break off and let the

valve turn over. This was on an old style Alco, which had two
711 lugs to hold the operating lever in the bottom. One would break off and let it go down the opposite way, resulting in no control of the valve. I have not seen any of these lugs on the new style Alco. When the lugs would break off it was necessary to shove the lever back in position and be careful to keep the cut-off limited in order to get in, resulting in some delay.

On October 3, 1926, I left Boone with engine 2908, the engine having come through from Council Bluffs. Upon arrival at Boone, the engineer had said to look out for the reverse gear. Going up Ames hill the engineer started to hook the lever up and it went into the back motion, stopping the train. It was thrown back so far that it was not possible to get a wrench on the bottom of the worm gear to turn it. However, finally with the aid of a bar, the lever was gotten back in forward position and the train moved on, having lost 30 minutes in the run to Marshalltown. After leaving Marshalltown it worked fairly well, and the time was made up. However, between Grand Mound and DeWitt, it again went into reverse motion and it was necessary to shut off steam and stop. After working on it we finally got it over, but going down into the station at DeWitt it went into back motion again and we were unable to release it. Finally I had to knock a pin out of the reach rod and we went on in to Clinton with the gear loose in the bottom of the links. Upon arrival at Clinton inspection was made of the gear and the foreman complained that he could not get it loose even with the reach rod disconnected. However, the next morning with a low air pressure it seemed to work. The valve was changed and no more trouble has been had. The gear was thoroughly gone over, but nothing was found wrong. At the time of the trouble we were carrying 110 pounds in the main reservoir, which is the normal pressure for an engine of that type. The reason the valve was changed was because it was not known what else to do.

712 I remember another case when an engine reversed herself and we had to drop the lever down to get her straightened out. That was on engine 2242, and the engineer told me that that had occurred several times before. With respect to gears lunging, by that I mean when the valve gear moved almost to the corner and back, I have had cases when I have been sent for by engineers who rode on class H engines where they were afraid of the engines and could not make any time, and in March 1931 I had two instances where I was sent for by the engineers. Take engine no. 3004, nothing was found wrong; however, when we got to Boone it was found that the connection was loose on the stem which operates the rotary valve. On engine no. 3005, when we got to Cedar Rapids the piston gland was tightened and that fixed it up so that we could get moving. We had it riveted at Boone, and after that it worked better.

I have had all kinds of cases of creeping on class J engines within the past five years, and all kinds of complaints from enginemen and

firemen that they were burning too much coal on account of the reverse gears creeping (T. 2539–2549).

We have done everything we could in the shops to overcome these various actions of the power reverse gears to which I have referred. I have followed the engines into the roundhouse and helped to take the gear down, and on the Barco it seemed that the gasket at the bottom of the worm gear caused the trouble. We took them out, removed the gasket and made a tighter fit on the thrust bearings, and sometimes that would last one month, two months, or three months. I have called the attention of the Barco and Alco people to the trouble we were having with the gears and they made different changes. They work with us in trying to stop the creeping, but they are still creeping. However, the Barco is better since they
713 put the lead gasket at the bottom of the worm, while the Alco is still creeping, although they are still making changes to overcome it. As to the Ragonett, I guess that has been given up. The Ragonett on most engines is a gear that you cannot work at the proper point of cut-off, because if you hook them up too close to creep, time is lost and the tonnage cannot be moved. It may be possible to work the lever with a light throttle, but in most cases, particularly at high speed, this can not be done.

I never had any difficulty with hand reverse-equipped engines in maintaining a fixed point of cut-off. I have never encountered, with the hand lever, any of the difficulties which I have referred to regarding the power reverse.

I have never been injured or seen anyone injured with a hand lever. I have never had any trouble nor observed other enginemen having trouble to keep a look-out or observe signals while operating engines equipped with hand levers. I have never observed any engineman failing to perform operations with the hand lever. I am a good-sized man myself and I have always had plenty of clearance on the various types of locomotives while operating them.

There is no occasion for an engineer operating a locomotive equipped with a hand reverse lever to get in front of the hand lever and be struck by it. Even in using the brake valve or the throttle, he would clear the reverse lever if it should break loose. I do not see where he would have any need to get in front of it. The first thing I was told when I started firing was to stay out of the way of the hand lever and to take care of myself, but that did not apply to the hand lever any more than to all of the operating parts. Nothing was said to me at that time about the hand lever except to stay out from in front of it.

714 In my entire experience I have never investigated or had reported to me any case of injury caused by a hand lever (T. 2549–2554).

715 June 19, 1931

H. L. WILLIAMS resumed on direct examination and testified.

(Reference was made to exhibit 25, a work report.)

The engine covered by the exhibit broke down at Lamont. There was a broken left valve crank reverse yoke as well as a broken eccentric valve on the left side. The left valve-head was knocked out. I was on the train at the time and brought the engine to Clinton. On the way to Clinton the reverse gear on the right side would not hold without its going at times almost to the front corner on that side. It would keep moving from one end to the other but did not move back over the center position. At Clinton we went all over the gear but found nothing wrong. The broken valve had lubrication so it was not dry valves which had caused the trouble. The engine was equipped with an Alco reverse gear.

As between the power reverse and the hand lever, I think the latter is safer in a number of ways, as it will hold the point of cut-off; it will also hold the engine while standing without air; and will keep the gear in condition while the air reverse does not always do that. With the hand lever the point of cut-off can be controlled, whereas with the power reverse that cannot always be done, and this means that more coal and water are used when the power reverse is creeping. The left valve head referred to was the valve chamber head. I do not know what broke the valve chamber head but its break could be caused on account of the reverse gear creeping and lunging. I cannot tell exactly what broke the other part.

(Exhibit no. 25 was received in evidence) (T. 2555–2560).

H. L. WILLIAMS on cross-examination testified.

On the occasion when the lugs broke on the Alco power reverse lever, the operating lever in the cab stayed in position and no one was injured.

716 Referring to the case with engine 2908 where at three separate places the reverse gear went in back motion, it stayed there, but no one was hurt. However, the train was badly jarred, but there were no broken parts as a result, either to the train equipment or to the locomotive. There are many things which can jar the train, but an engine reversing itself will jar it about as much as any one thing because it will cause considerable slack. We do have jarring of trains by causes other than engines reversing, but not often.

In many cases where I have observed power reverse gear creeping I have found that when it creeps forward it will come back of its own accord to the position where it formerly was, but it won't stay there for very long. I would say in most cases it comes back of its own accord and in time will travel down, maybe not right

away—maybe it will go aways and then come back. If you have an engine creeping and move the lever to readjust the cut-off that does not stop the creeping. That is not a way to control the creeping. It is just a way to get by, the engine is burning more coal and using more water. By "getting by", I mean drifting with them and easing off on the throttle, and when you do that it does not always bring the engine back to the desired cut-off, and it is not very often that such action results in bringing it back to the desired cut-off as they are creeping from some other cause. On occasions when it is found necessary to tighten the gland at the end of the air cylinder, it is necessary to stop the train, although it is not much of a job to make the adjustment. In some cases that adjustment takes care of a good bit of trouble, while in other cases it does not. I cannot say what all the causes of creeping are. However, I do know some of them, such as defective part of the gear; bad order valve; leakage; tightening leaks around either head, and lost motion in the gear. I would not say that most of the trouble is with air leaks around the piston of the gland. I think the most trouble is with the rotary valve itself. The valves I am referring to are those on the Alco and Barco types, which rotate and thus
717 open and close the ports and which operate on the same principle as the rotary valves on the air-brake system. This valve on the air brake does not give any trouble. It is not altogether a matter of maintenance of the power reverse to keep it in good operating condition. We have a good many power reverse mechanisms, but I do not believe we have any with which we do not have some trouble, and there are times when they continue to creep although everything has been done that you know of. We try to keep all power reverse gears in serviceable condition, and when engines are inspected such inspection includes an examination of the power reverse. When an engine goes into the shop the power reverses are taken down and overhauled, the same as the rest of the locomotive. There are other times when the reverse gears are examined and checked, such as when the engineer reports it, and by the man who takes care of the gear. Any lost motion in the connections that affect the movement of the valve will throw it from its normal position and affect the moving of the gear, causing creeping. This lost motion is in the pins and bushings in the movable parts that control the rotary valve. Some times it is in the connection to the valve. Lost motion in the link or the tumbling shaft should not make the gear creep. With the Barco and Alco types I would say there are six or seven pins in the operating mechanism of the air reverse valve (T. 2560–2568).

(There was offered in evidence complainants' exhibit 28½, cuts and diagrams of the Barco B–2 and B–3 power reverse, which was received.)

From examination of exhibit there are shown to be six places in the valve mechanism and operating lever where there would be lost motion enough to cause the power reverse gear to creep. It is pos-

sible to get enough lost motion in any one of those places to cause creeping. However, it would have to be rather bad
718 and this would apply more to the Alco than to the Barco but if you have a lot of slack in either the gear will not respond. I have seen one bushing so badly worn that it will affect the working of the gear but that was a case where the maintenance department fell down on the job. I will agree that the lost motion is our fault but when everything is in shape and they still creep, as a number of them do, we cannot help it. When everything is in shape the creeping is due to something about the construction. With the Barco there is difficulty with the gasket leaking at the bottom of the worm gear, which affects the bar on the air cylinder and thus causes creeping. While a new type of gasket has been installed in the Barco, the difficulty has not been entirely overcome. I can not state the exact portion of gears which are in good condition but which creep. It is my experience that creeping of the gears is pretty regular.

There has been no change in the Ragonet gear in the past 10 years.

I have no difficulty whatever with hand levers. All that I have seen have been in such condition that they could be operated without any difficulty. While I have seen some such gears with lost motion, we do not let them get that way. I do not remember of seeing a hand operated lever with stop pins missing. I have never observed a lever with enough play in the latch or lost motion which would cause it to move back and forth in the notches of the quadrant. I have never seen one shake until it would go out of the quadrant in my recollection. However, I have seen them rattle in the quadrant. On the R–1 engines there would not be much clearance between the end of the lever and the boiler, or any pipes on the boiler, where the lever is in full forward motion with the stop pin out. I can not say whether in such a case there would be sufficient room for a man's hand to go through the space between the lever and whatever
719 object was there. I have no knowledge of any one in my territory having been injured while operating a manual reverse. I know most of the accidents that happen to men in my territory and help to investigate them. While I have (T. 2568–2575) never had any experience with the strap on the back end of the main rods breaking, I do know of such a break. If the strap broke, I do not know that any thing would happen to the valve gear and manually operated lever. However, it might be possible for it to hit the reach rod.

If in reversing an engine the counterbalance spring should fail, the reverse lever would be thrown out of balance, but I do not know why a man should be injured under those circumstances. If in hooking up an engine any part of the reversing mechanism were to become loose, it is possible the man handling the lever might be injured, although I have never seen that happen. I do not say that there are no possibilities for an engineer being injured by manual levers while

operating same, as one can be hurt by anything. We do not instruct our engineers to keep out of the way of the manually operated lever more than of any other thing. We do not mention the lever any more than any other part of the locomotive, and I do not recall telling anyone about the reverse lever any more than just a general precaution. I have never instructed men where to put their feet when handling the manual lever. I have never had to instruct an engineman on how to hook up an engine. If I should be going 35 miles an hour with the hand lever fairly well hooked up and wanted to bring it up two or three notches, I would reach over and hook it up and put my feet wherever necessary. I have never found anything dangerous about a hand lever—and in most cases I hook them up with one hand. However, where the gear was new and the engine handled a little hard, one would have to brace himself by putting his feet on the stop pin, but there is nothing dangerous about that,
720 and while running an engine I have braced my feet against the stop pin, but that would depend upon where the reverse lever was. If it was up ahead and it became necessary to get hold of it, you would necessarily have to brace yourself. In my territory it is not the practice of enginemen to put their feet against the boiler head or pipe and thereby brace themselves. However, I have seen that done, but most of the men on passenger engines reverse the engine sitting on the seat box (T. 2575–2581).

I have had hold of the lever when valves were dry and had to be a little careful because I knew that if I did not take hold of the lever it might get away from me.

I have been road foreman since 1918, having been promoted from traveling fireman. I only ran a trip or two as an engineer. I was a fireman from 1907 to 1911, at which time I was made traveling fireman. The engines which I fired were equipped with hand levers. However, after I was made traveling fireman I fired a number of them equipped with power reverse but never as a regular fireman. The reason I fired in my position as traveling fireman was to instruct firemen.

I cannot tell what percentage of locomotives under my jurisdiction at this time are equipped with power reverse, but I would say the greater number are so equipped.

We have a fuel department, with which I am connected to the extent of helping save coal. We do not hold classes to instruct engineers and firemen. We do give them personal instructions and issue bulletins, the bulletins being to tell the firemen what to do with reference to black smoke and similar things. Instructions as to the method of firing engines are give on the engines. We have such things as pictures and printed matter to tell firemen what we want them to do, which are issued while riding the engine with the firemen.

721 I do not know whether the fuel department makes reports of any kind to any officials of the company. At the end of

each month I make out a report to the chief fuel supervisor with respect to the check of coal on engines which I have ridden.

When we first got power reverse gear we found out that they crept and caused the burning of more coal when we could not control the cut-off. By "we" I mean myself and the men with whom I work. The first engines equipped with power reverse were the type J, which we first got in the Iowa territory along in 1918. However, I can not recall the first engine which crept while I was riding on it. When I saw the gear creep on the type J engine, I observed the effect on the fuel. The first group of engines received on the Iowa division with power reverse numbered about 50, but I do not know how many of them crept. However, at times most of them did, and when they did creep the excessive use of coal was noticeable (T. 2581–2587). Possibly 10 or 15 percent of these locomotives were worked upon for creeping during the first three months that they were on the division, and I noticed that they burned more coal when the cut-off could not be controlled. I cannot tell how much of the time that 10 or 15 percent crept to such an extent that I could observe the excessive fuel consumption. They did not creep every trip. Work was continuously performed on them and sometimes they would stop creeping and go all right for a while. The frequency would possibly be once a month, maybe once in two months. The excessive use of coal is no better now than it was at the time we first got these engines. That is, in the thirteen years we have had them I do not think there has been any improvement in the actual operation of power reverse gears. In other words, as a whole
722 I do not think there has been any improvement. I would say on my division that as many as three tons of coal each way is wasted on account of creeping power reverse. On the run of 200 miles between Clinton and Boone if the power reverse did not creep there would be a saving of from two to three tons of coal. On that run with a class H engine about 25 tons of coal is burned, sometimes more. This run is made with time freights in between 7 and 8 hours with a stoker-fired engine. We have never operated a freight train over that division with a comparable engine; that is, one of about the same weight and tractive effort equipped with a manual reverse bar. I arrive at the estimate of three tons of coal saved by checking the same engine when the gear was creeping against trips of that engine when the gear did not creep. My judgment would be that about one-third of the engines operated in the territory in question do not hold the cut-off at the proper point. There have been numerous complaints from firemen that they were burning too much coal (T. 2587–2597).

H. L. WILLIAMS on redirect examination testified.

In order to tighten the gland on the power reverse it is necessary to get up on the driving rods of the locomotive because of the height of the gland from the ground. We have a machinist assigned to the job of looking after reverse gears, and an effort is made to keep the

lost motion to a minimum and it is checked up at the time other work is done on the gears. A greater amount of work is necessary on power reverse gears than on manual reverse gears. If there was the same amount of lost motion with hand levers I do not think it would be as serious as the same amount of lost motion on a power reverse, and that is true generally with respect to the other parts of the reversing gear. I have had no different experience with the creeping on the Ragonnet gears than on the Barco and Alco, and my experience in general applies about equally to the three classes of gears (T. 2597–2603).

723 H. L. WILLIAMS on recross-examination.

If there is lost motion in the valve gear on power reverse it would not have much effect on the lever in the cab. On manual reverse if there is lost motion in the valve gear there would to some extent be an effect on the manually operated bar (T. 2603–2604).

C. A. JEFFERS was recalled as a witness and testified.

In referring to the word "creeping", it is my understanding that it means any undesired movement of the power reverse gear or parts affected thereby not controlled by the hand lever in the cab, whether the engine is moving or standing still (T. 2604).

724 T. W. WATT, employed as a hostler by the Chicago and North Western, residing at Chicago, Ill., testified:

I was first employed in engine service on September 30, 1911, and promoted to run an engine in the spring of 1915, since which time I have been continuously in service except while in the Army. I have had experience running all classes of engines except the H's and in all classes of service.

My present assignment is as hostler at 40th Street, Chicago, and I have had experience in operating both hand levers and power reverse gears. I have never had any experience with a hand lever becoming unlatched and going down to the corner, nor of one pulling away from me after I had unlatched it. I have never in any way been hurt by a hand lever, neither have I at any time exerted undue physical effort in handling them. I have had the job of breaking in engines. While operating engines with the power reverse gear, I have had them creep and have also had cases where the reverse gear worked all right. I have noticed the valve parts and power reverse gears move on engines while standing, and when there has been no movement of the operating lever. I have noticed engines while standing in the roundhouse start, especially with the Alco gear. I have seen the reach rod, valve gear, and valve motion move, sometimes fast and sometimes slow. I have never experienced any breakage with any part of the power reverse gears (T. 2605–2609).

In May 1931, engine 1658 came in on a regular run. The fire was knocked out and preparations made for it to go into the roundhouse.

The steam was down to around 75 to 80 pounds and there was between 40 and 50 pounds of air. Going into the roundhouse I heard a noise of air escaping, so I applied the brake in emergency and stopped. I tried to hook the engine up in the center and opened the cylinder cocks, but I could not move the lever in the cab
725 which operates the power reverse. The engine was equipped with an Alco gear. An investigation showed that a lug had broken off into the casting where the rotary valve works, and that what air was in the main drum was escaping instead of acting as power to pull the engine up on center. I stopped the engine where I wanted to. There was a roundhouse employees' washroom in front of the engine and if I had not gotten her stopped she would have gone into this room. That kind of an accident could not have happened on an engine equipped with a hand lever.

In February, engine 2642, type M–4, was standing waiting to be coaled, and a class Z engine came into the coal yard and coupled up to 2642. The brake was left released on this class Z engine, although the brake was applied at that time on no. 2642. I noticed the two engines moving. I jumped on no. 2642 and pushed the brake over to set it in emergency but there was no air. About 70 feet from where I had gotten on the engine was a switch engine having the fire cleaned. A man was working on it. I dropped off of engine 2642 and got on the class Z engine which had air. I set the brakes and stopped the two engines. An investigation showed that someone had shut off the pump instead of the steam valve to the lubricator, the result being that air leaked off of the engine. When I first got on engine 2642 I made no attempt to throw the power reverse lever as I knew, if I could not apply the brakes connected with the main drum in emergency, that the power reverse would not operate, because there was no air on the engine. If the engine had been equipped with a hand lever, I could have controlled it by throwing the engine into forward gear.

It is my opinion that the hand lever is the safest. I would say that the hand gear is faster than the Barco, but not faster than the Ragonnet and Alco (T. 2609–2616).

726 T. W. WATT, on cross-examination, testified:

As to whether you can throw an engine over with power reverse, with the pump working, that depends upon whether there is enough air. I have had occasions where the pump was working but there was not enough air to throw it over, as, for instance, in the roundhouse where the steam pressure is low due to the fact that the fires are being cared for.

I was not on the Z engine above referred to until I got on it for the purpose of stopping. The throttle on this engine was closed and the lever was on the center. At this particular point the track inclined forward. I could not say as to whether it was the weight of the Z engine which started the engine to moving. Engines will start on that track without brakes, because it is

an incline built for coal cars to run by themselves after they are once started. As to whether an engine would roll away under those circumstances, whether she has steam or not, that depends on the engine. If an engine would roll away without steam and it was equipped with a manual lever, you could not control it.

I have observed manual levers operate harder on some occasions than on others, such as where the engine is new and the bearings are not properly lubricated. Dry valves will cause a lever to work harder on some occasions than on others, as well as the working of water.

Counterbalance springs sometimes get out of adjustment.

I have had occasion to hook up an engine running about 35 miles an hour, and at that speed, if I knew I had a dry valve or was working water, or noticed the lever was rattling or anything like that, I would get the feel of the engine, that is, take hold of the forward end of the reversing lever and without touching
727 the latch find out if there was enough pull to jerk me. I have never had a lever get away from me and under ordinary circumstances, I put my hand on it and pull it where I want it. When I feel vibration from dry valves I unlatch with one hand and retain hold of it with the other. I have never had occasion to brace myself.

The M–4 engine heretofore referred to, upon which I tried to set the brakes, weighed around 231,000 pounds on drivers. I have never operated an engine of that weight with a manual lever. The heaviest engines I have operated with such levers are the E's and the Z's, the latter weighing around 214,000 pounds on drivers. The lightest engines I have operated are the class K–3 and small work train engines, and the weights would be under 100,000 pounds on drivers. The larger power is harder to handle than the smaller power, but if everything is in perfect working condition I can throw the heavy engines as quickly as the light engines, and I have never exerted myself in throwing any of them (T. 2616–2624).

It takes more strength to throw a heavy engine because the parts are heavier. I have never noticed any greater pull on the manual lever where it is on a heavy engine. It is my opinion that a manual lever would be safer than the power reverse lever, that is, the hand lever is safer around the roundhouse where it is necessary to operate with turntable pits and men working. I have never been hurt with the power reverse lever and have, therefore, never given any thought to the question of the safety of the reverse lever—that has never bothered me. I have done my work, and that is all there is to it.

On the occasion where the lug over the rotary valve was broken, there was a very heavy leak of air, but that would not have ulti-
mately set the brakes. It would have drained the main air
728 reservoir, but that has nothing to do with setting the brakes on ET equipment (T. 2624–2630).

E. G. BATES, a locomotive engineer employed by the Chicago and North Western Railway, residing at Sioux City, Iowa, age 64 years, weight 122 pounds, testified:

I operate between Omaha and Sioux City. I was first employed as a fireman on October 5, 1887, and promoted to engineer on September 10, 1891, and have been continuously running engines since that time. I have operated all classes of service with all types of engines, from the little 15-inch up to the Z. I am now handling Minneapolis, St. Paul, and Kansas City limited trains in passenger service, using the Pacific type passenger engine class E, weighing 154,000 pounds on drivers, equipped with hand reverse.

I have never been strained or overtaxed physically in operating with the hand lever, and never had such a lever pull away from me after I had unlatched it in the quadrant.

My experience with the power reverse gear is very limited. At the time I used it my regular engine was being repaired. The engine that I received with the power reverse, the name of which I do not know—I asked an experienced man what I was supposed to do with the thing as I had never handled one and had never been instructed as to how to handle one. I backed over to Omaha, a distance of about 3 miles and I had to cut the engine off. I had to throw the engine back and I, therefore, reached over and did so, and the lever came back. There was no movement, but all at once she took a bang and hit me. I had to use this engine through to Sioux City on one trip and I did not make out very well with it. I hooked her up and got her to the position where she should be, and she would be working harder than I would want it to. I would look at the lever
729 and it seemed to be in the proper place, but I pulled her up a little more and got her back. The distance from Omaha to Ottawa was 61.25 miles and I ran 32 miles out of Ottawa. I had enough water to coast her in, and when I got to Sioux City I had used about 2½ tons more coal than usual, and I told the fireman, "If that is what the power reverse is, I will take the old hand lever for me." That is the only experience I have ever had with one of them. Based upon that limited experience I do not see any advantage to be gained by putting power reverse gears on engines, either from the standpoint of efficiency, economy, or safety (T. 2630–2635).

730 GEORGE S. EDMONDS, superintendent of motive power of Delaware & Hudson Railroad Corporation, testified:

I have been employed by the Delaware & Hudson Railroad Corporation and its predecessors, the Delaware & Hudson Company, for 10 years.

It is the policy of the Delaware & Hudson to study major projects a decade in advance, where possible. Tentative programs covering such projects are usually prepared five years in advance of their application, where possible. Annually, prior to the beginning of

each calendar year, addition and betterment budgets are prepared under instructions which require that:

1. Addition and betterment projects for the succeeding year shall be prepared and presented on the first day of November of the preceding year.

2. Budgets shall be composed of:

(a) Items listed in the order of their importance and necessity.

(b) Plans and estimates in detail.

Among the projects included in the budget, under the heading "Mechanical department", is the item "Power reverse gears."

Delaware & Hudson has 436 locomotives on its properties of which 95 are light locomotives of less than 32,000 pounds tractive power, and 50 of these locomotives are likely to be retired from service within five years.

During the six years preceding the year 1931 the average application of power reverse gears by Delaware & Hudson, under its budget authorization, was about 25 per annum; a total of 148 gears during that period.

Prior to the year 1925 Delaware & Hudson had applied 18 gears to its motive power. Since the beginning of the application
731 of power gears to its motive power it has received 39 locomotives from the builders with power reverse gears already applied.

To date, therefore, power reverse gears have been applied to 205 of its locomotives.

The status of the Delaware & Hudson locomotives for the period since the beginning of the year 1927, with respect to locomotives owned, stored, and in active use, is as follows:

| Year | Owned | Stored | Active | Year | Owned | Stored | Active |
|---|---|---|---|---|---|---|---|
| 1927 | 461 | 98 | 363 | 1930 | 445 | 125 | 320 |
| 1928 | 460 | 110 | 350 | 1931 | 439 | 148 | 291 |
| 1929 | 452 | 102 | 350 | | | | |

At this time there are 436 locomotives on the property, of which 291 are in active use. In general, power equipped with power gears is in active use, so that over 60 percent of the locomotives in active use on Delaware & Hudson are equipped with power reverse gears.

The earnings and the resources of the Delaware & Hudson Railroad Corporation have been so reduced during the current depression in business that projects of the mechanical department have had to be restricted.

Several years ago the corporation undertook to stabilize employment and, even during the present depression, has succeeded in giving continuous work to all employees on its shop payrolls. It has not discharged or laid off any employees, except for cause, during the present depression. In order to accomplish this, which it believes to be in the ultimate interest of the company, as well as in

that of its employees and the public, it has been and will continue to be absolutely necessary to conserve its resources and to
732 postpone every capital expenditure that can be postponed without sacrificing in operating efficiency and in the safety of the public and its employees.

This condition is shown by comparative figures showing gross revenues and net railway operating income for the first five months of the years 1928, 1929, 1930, and 1931, following;

*Gross revenues*

| Month | 1928 | 1929 | 1930 | 1931 |
|---|---|---|---|---|
| Jan | $2,935,719 | $3,191,789 | $3,323,002 | $2,757,303 |
| Feb | 2,978,186 | 3,210,472 | 3,227,258 | 2,568,667 |
| Mar | 3,059,044 | 3,157,868 | 2,927,777 | 2,522,900 |
| Apr | 3,223,063 | 3,422,078 | 2,914,740 | 2,700,067 |
| May | 3,711,317 | 3,574,623 | 3,254,924 | 2,653,665 |
| Total | $15,907,329 | $16,556,830 | $15,647,701 | $13,202,602 |

NET RAILWAY OPERATING INCOME

| | | | | |
|---|---|---|---|---|
| Jan | 14,193.61 | 334,677.76 | 395,946.43 | 167,649.93 |
| Feb | 299,038.70 | 533,902.89 | 490,299.21 | 191,103.65 |
| Mar | 191,541.88 | 331,421.05 | 203,065.88 | 82,947.23 |
| Apr | 637,097.94 | 660,497.96 | 290,391.64 | 336,905.46 |
| May | 1,142,948.02 | 755,155.45 | 533,186.76 | 353,020.08 |
| Total | $2,284,820.15 | $2,615,655.11 | $1,912,889.92 | $1,131,626.35 |

These figures indicate that the gross revenues of the Delaware & Hudson Railroad Corporation during the first five months of 1931 declined over 17 percent from the average gross revenues from the operation of the same properties during the first five months of the years 1928, 1929, and 1930.

On the same basis, the net railway operating income of the Delaware & Hudson Railroad Corporation, during the first five months of 1931, indicate a decline of over 50 percent.

I have examined the transcript of testimony given in this proceeding on behalf of the complainants by two engineers from the Delaware & Hudson, wherein it is stated, in substance, that
733 the application of power reverse gears to small types of locomotives is as necessary and desirable as their application to the large heavy types of locomotives. It is my opinion, based upon long experience in motive power operations, that there are classes of locomotives, including those concerning which testimony was given by our engineers to which the application of power reverse gears is unnecessary and undesirable.

In my judgment, the expense incident to the application of power reverse gears to such classes of locomotives would be entirely unwarranted, extravagant, and inconsistent with the efficient and economical management required by the Interstate Commerce Act.

In this situation, it is the view of the management of the Delaware & Hudson that (1) power reverse gears may be applied to cer-

tain types of heavy motive power advantageously, when its earnings permit expenditures on projects which are desirable but not essential, in the interest of safe and efficient operation of the properties; (2) the application of power reverse gears to certain classes of motive power would be wasteful, unnecessary, unwarranted, and inconsistent with efficient and economical management; and (3) the management should be allowed to exercise its discretion and judgment in the application of power reverse gears to their motive power, consistently, among other things, with the financial condition of their companies (T. 2636–2643).

734 GEORGE S. GOODWIN, an assistant to the general superintendant of motive power, Chicago, Rock Island and Pacific Railway Company, residing at Chicago, Ill., testified:

I have been employed by the Chicago, Rock Island and Pacific Railway Company for 26 years, and have been in my present position for a period of about 6 years. I and my immediate superior are accountable to the general superintendent of motive power, and he in turn is accountable to the vice president in charge of operations. I and my superior have direct supervision over the mechanical department. I am personally familiar with the policies of the vice president in charge of operations with respect to the mechanical branch of the operating department, and I am reasonably familiar with the issues in the present case. I have some charts which show conditions in the shops of the Rock Island railway, which were prepared under my supervision and direction, and which reflect an accurate situation. (Document referred was thereupon marked for identification as defendants' exhibit no. 29.)

The first chart shows in graphic form the number of days the shops were worked per month for the years 1928, 1929, and 1930, and up to the end of May 1931. At the left side is shown the scale of days worked per month, and across the top is shown the month of the year. At the top is also stated numerically the actual number of days per month. The chart shows that in the first part of 1928 the shops were working approximately 21 days per month, then the time was increased and during the rest of the year 1928 and 1929 the shops were working approximately 25 days per month. Then the depression started, and the time was reduced. It was reduced in the month of March to 10 days per month, then it was increased for two or three months, and then it was reduced even to no time
735 worked in the month of August 1930. Since then the days worked per month have been approximately 10. This chart shows 27 days as the most they have been worked in any month under normal conditions.

Chart no. 2 shows the output of the locomotive shops per month, and is gotten up in the same manner as the first chart. It shows: The time across the top, the scale of the output, and locomotives receiving general repairs per month. In the latter part of 1928 and through 1929 we were turning out approximately 54 general repairs

per month. Then the depression started and the average dropped to about 20 general repairs per month during the last year. One month we were shut down there were only 10 engines turned out.

Chart no. 3 shows the average mileage of locomotives between shoppings. On the left side is the scale of the mileage. Across the top is the time. It shows that at the beginning of 1928 the mileage of locomotives between shoppings was around 56,000 miles. That was gradually increased until the mileage of engines between shoppings on the last date shown, May 1931, was 83,000 miles. That mileage is obtained by computing the mileage of all the engines receiving general repairs in any one month, dividing it by the number of engines receiving the general repairs, and thus arriving at the average mileage of the engines repaired. The engines which are selected for the shopping are those on which there is the greatest need for repairs, hence this mileage is fairly representative of the condition of the power.

Chart no. 4 shows the mechanical department forces, the mechanics, helpers, and apprentices. The scale on the left shows the number of men employed. It shows that at the beginning of 1928 there were 6,600 men employed, which increased gradually until
736 November 1928, where there were 6,847. With the beginning of the depression the force was reduced until at the present time there are approximately 4,500 men employed, the figure for the end of May 1931 being 4,234.

The last chart shows the maintenance of equipment labor expense. It shows that we were spending $950,000 per month at the beginning of 1928, and in April 1929 we were spending $1,127,000. With the depression, the labor expense per month has now dropped until it averages something like $670,000, the last figure being $633,300. (Exhibit no. 29 was received in evidence.)

The purpose of this exhibit is to show the economy policy in use on the Rock Island, as it applies to the mechanical department. Under my direction an estimate of $329,250 was made as the cost to the Rock Island to equip with power reverse the locomotives which are not now so equipped (T. 2643–2649).

GEORGE S. GOODWIN, on cross-examination, testified:

The cost of installing power reverse would be $375 per locomotive and would be the same for all engines; and of this $375, approximately $280 is for material, leaving $95 for labor. These figures are based upon the actual cost of applying the gears on a number of engines and are for Alco gears. On these completed jobs, power gears have been installed where the air pump is on the right side. We have locomotives not equipped with power reverse gears where the air pump in on the right side, and in installing a power reverse gear on these engines it will probably be necessary to transfer the air pump to the left side of the engine, and the cost of that would vary, depending upon how much obstruction was run into on the other side of the engine. On a modern engine the air capacity or reservoir

737 capacity is large and sometimes the space is pretty well filled up. It would cost from $25 to $50 to change the air pump, including the piping and possibly incidental changes. This sum would be in addition to the afore-mentioned estimated cost per locomotive.

In March 1928 the mileage of locomotives before they were repaired was 54,000 miles, while those repaired in May 1931 had averaged 83,000 miles before shopping. The reason for this difference of 27,000 miles between shoppings is that our shops were working during the last year practically only 10 days a month; our forces were reduced from a maximum of 6,800 men to about 4,500 men. Engines taken into the shops at the time when the mileage was 54,000 miles were not in the same condition as they were when taken in with a mileage of 83,000 miles. I would say that the conditions were not as good with the longer mileage as they would have been had there been only 54,000 miles accrued. When the engines were sent into the shops at 54,000 miles, they had need for repairs. Engines would have been shopped before they got a mileage of 80,000 miles if our shops had been working the full time with full force.

This mileage between general shoppings would not tell the whole story because of running repairs. However, our examination of such repairs has not disclosed that there is an abnormal increase. Running repairs can be kept up or let down to an extent which will materially influence the mileage between general shoppings. Our running repairs have not increased to a great extent between the early part of 1928 and the present time. This chart indicates that our power is deteriorating and getting into a poor condition. The mileage since last repairs is increasing (T. 2649–2653).

H. F. DITTBRENNER, a statistician for the Chicago, Rock Island and Pacific Railway, residing at Chicago, Ill., testified:

738 I have been employed by the Chicago, Rock Island and Pacific Railway for 29 years, and as statistician, in some shape or other, since 1907. I am reasonably familiar with the issues in this case, and have exhibits which have been prepared under my supervision, which to the best of my knowledge and belief show accurate facts. (The exhibits were numbered for identification as 30 to 34, inclusive.)

Exhibit 30 is an income account for the five years ending December 31, 1930, and for the four months ending April 30, 1931. It shows the operating revenue split between freight, passenger, and miscellaneous, and the operating revenues split into general accounts, taxes, uncollectible railway revenues, and detail of nonoperating income and detail of deductions from gross income bring it down to the net income or deficit. In 1926 the net income, in round figures, was $11,500,00, which increased each year until the peak in 1929 of $14,000,000. In 1930 there was a decrease to $7,700,000 or approximately 50 percent. For the first four months of 1931, operations

have been at a deficit of $467,571. This deficit is, in my opinion, an unusual condition. Exhibit 31 will show the situation.

Exhibit 31 shows the four months ended April 30 for the years 1926 to 1931, inclusive. The first year, 1926, shows a deficit of $578,000; the next year shows a profit of $2,168,000; 1928 shows a profit of $2,500,000; in 1929 the profit was $2,231,000; and in 1930 the profit was $952,000. In 1931 there was a deficit of approximately $467,000.

Exhibit no. 32 shows property investment, net railway operating income, and the rate of return for the years ended December 31, 1923 to 1930, inclusive. It shows earnings of: 3.5 percent in 1923; 4 percent in 1924 and 1925; 5 percent in 1926, 1927, 1928, and 1929; and 3.84 percent in 1930.

739 Exhibit no. 33 shows traffic statistics for the years 1926 to 1930, and the first four months of 1931 with the exception of revenue tons carried per mile, in which connection I have only shown three months which were the latest available. In the first column is shown train miles including a portion of mixed trains, the freight train miles for each year; and in the next column the percent over or under 1926. It shows that 1930 was 6 percent under 1926. The passenger train miles shows 7.2 percent under 1926. As to the revenue tons carried one mile there was an increase of 2 percent over 1926, and a decrease of 17.3 percent under 1929. The passengers carried one mile decreased approximately 29 percent under 1926.

Exhibit no. 34 shows the number of employees by subclasses for the years 1926 to 1930, and 1931, divided into quarters, that is, March 15, June 15, September 15, and December 15. It shows the number of employees in all classes of service, the attachment showing just what employees come under the subclasses. It gives the percent of increase or decrease 1930 under or over 1926. The average number of employees during the year 1930 decreased 12.8 percent under 1926. (Exhibits 30 to 34, inclusive, were received in evidence) (T. 2653–2658).

740 C. W. BURKHALTER, locomotive engineer employed by the Chicago, Burilngton & Quincy Railroad Company, residing at Berwyn, Ill., age 57 years, testified:

I was first employed in 1896 as a locomotive fireman, promoted to engineer in 1905 and my experience as an engineer has been continuous since that date. I have operated locomotives ranging in weights on drivers from 90,000 to 307,600 pounds in all classes of service.

I first operated power reverse equipped locomotives in 1912 ranging in weight from 180,800 to 307,600 pounds.

I have operated locomotives equipped with manual reverse gears ranging in weight from 90,000 to 209,000 pounds. Since 1912 I have operated hand reverse approximately 40 percent of the time and power gear 60 percent, the power reverse being of the Ragonnet type. I have never had a manual reverse lever fly out of the quad-

rant and go to the corner, nor thresh back and forth over the center. I have never had any trouble in operating a hand reverse gear outside of when breaking in a new engine. My customary way of operating a hand lever is to use one hand and sit on the seat. I have never had an accident while operating the hand lever nor seen anyone have an accident while operating such lever.

I have had difficulty with the power reverse gear creeping, that is, not maintaining a fixed point of cut-off, and have had that trouble with the majority of power reverse gears which I have operated. I have had two accidents with the power reverse gear, the first one happening on July 10, 1917, at Altoona, Ill., with engine 5246. I had started out of the yard at Galesburg with some 80 cars and the engine crept so badly that the fireman could hardly keep coal and water in it. At Altoona I stopped for water, oiled the engine, and looked it over, backed up to the train and found
the reverse gear in forward motion. I stepped down on
741 the frame of the link holder and shut off the air in back of
the main drum. I took the cap off the air reverse gear but could not see anything wrong. I then mixed up some black oil and water and poured it in, which I had been instructed to do in order to soften up the gasket in the main piston. I replaced the cap and tightened it up, went down stood on the frame, and turned on the air to the reverse gear; the lifting arm on the back end of the lifting link arm caught my foot with a hexagon nut on this lifting arm, taking it down through a space of one-fourth inch, crushing the whole foot and pulling out the second toe by the root. I called to the fireman to reverse the engine which he could not do. I then called to him "Let her go." After the engine had gone the full course down he could reverse but that was too late. When we cut the engine off the fireman and I sat on the pilot and the fireman ran the engine to the station one mile away where I asked for permission to be taken back to Galesburg to a doctor. When my foot was caught I was in a position to see whether anyone was on the right side of the cab and I saw no one there. By reason of the accident I was off duty for 87 days for which I was paid $2 a day. The doctor bill was paid by the Chicago, Burlington & Quincy and I was not in a hospital (T. 2660–2667).

The second accident occurred in the fall of 1930 at which time I was operating in freight service and was setting out cars at Mendota, Ill. I was putting the engine in reverse motion. When I started to pull the reverse from the back it took both hands to move it as it was new and very stiff. When I got it about half way back it suddenly stopped and my hands and gloves being greasy my hands slipped behind the latch and sprained the thumb and knocked it out of place. That engine was equipped with a Ragonnet
gear and I was off duty with the sprained thumb for two days.
742 I had a collision while operating a locomotive equipped
with power reverse gear. It was during the winter time when I was getting an engine ready. I tried the air on the engine and

the reverse lever and had to wait around an hour before it was time to move. I started to back up and let off the straight air and about that time another engine started into the cinder pit ahead of me. I shut off the engine and set the air but did not have any as it was frozen. Then I reached for the reverse lever and did not have any as it was also frozen, the result being that I ran into the tank of the other engine. It is my opinion that this particular accident could not have happened with an engine equipped with the hand reverse lever because I could have gotten such lever over and had the engine going the other way at the speed I was moving. I had not shut off the pump in this particular case.

About 1913 at the roundhouse in Mendota, Ill., an engine was standing on the storage track and a machinist was working around it. While watching him I saw the reversing gear start down. I went over and said "What is the matter" and he replied, "That thing went down and caught me. It came near breaking my arm." The machinist was working on a short step ladder reaching in under the engine tightening up a bolt on the frame. His arm was caught by the lifting arm. There was no one in the cab of the engine at that time and I do not know what caused the gear to go down as I did not investigate it.

It is my practice to inspect my engine before going out, which inspection includes the various parts of both the hand reverse and power reverse. However, I am able to make the best investigation of the hand reverse because there is not so much of it, while there are parts of the power reverse that I cannot see (T. 2667–2673).

743 I have had three train delays as a result of the improper functioning of the power reverse gear. In the winter of 1912 I was sent to Galva, Ill., to relieve an engineer, and when I arrived the steam was blowing out of the cab around the reverse gear so badly that I could not see the front of the engine or anything else. I asked what was wrong and was told that the gasket was blown out and the engine could not be used because it set the air on the train. A gasket was sent from Galesburg which I put in. That power reverse was not functioning properly because it did not have the pressure. It was blowing out around the cab and the gasket. I was delayed one and one-half hours. The hand reverse does not have such a gasket.

In 1927 at Galva, Ill., the nipple which connects the air line from the pump and from the steam dome broke at the sliding valve. The engine at that time was moving about 25 miles an hour, the result being that I was unable to handle the engine either with steam or with air, as I could not get any power to the reverse gear. This breakage stretched the train out so I could not take up the slack with reverse gear. It set all the the train brakes and blocked all of the crossings in the city of Galva for 40 minutes. On that occasion I had to disconnect the pipe, and while I was doing this the fireman took out the broken piece which I took over to the roundhouse and fixed.

The third delay occurred at Hinsdale in 1928 and the accident was the same kind as the preceding one at Galva. At that time all the brakes on the train were set, blocking the streets. In neither of those instances was I able to operate the power reverse gear. At Hinsdale I was delayed 35 minut's, but was able to make repairs.
744 None of these accidents could have happened had the engine been equipped with hand levers, because I could have taken up the slack in the train had the brakeman bled the air and cut the crossings. Based upon my experience it is my opinion that the hand reverse is the safer, because you can see and know what the hand lever is doing at all times. It is also my opinion that the hand lever is the more efficient because the power reverse gear is hard on the fireman's back, the coal pile, and water. With the hand lever better work can be done (T. 2673–2678).

C. W. BURKHALTER, on cross-examination, testified:

I am a member of both of the engineer service brotherhoods and have operated a manual reverse engine in freight service weighing 209,000 pounds, which is a 2–8–2, 0–1–8 type. While operating an engine of that type on the road, running, I hook her up with one hand while sitting on the seat. The highest speed I have had occasion to hook that engine up is around 30 miles an hour. I would not try to hook her up at that speed with dry valves; I would first ease her off a little so that I would not have so much to work against. I would give the engine an opportunity to oil up first. I have had difficulty in reversing engines new out of the shop.

Engines handle harder when there is steam in the cylinders, and if the engine is new and has steam in the cylinders I take both hands in order to throw the lever. However, if it is not new out of the shop I do not use two hands. I can throw an engine over with steam trapped in the cylinders providing she is not new out of the shop. I am now operating a passenger engine equipped with manual reverse which weighs 150,000 pounds on drivers and is the largest I have used in passenger service. In passenger service I have seen the hand lever vibrate in the quadrant and rattle. The greatest cause for that is having too long a reach rod between the grip and the dog. Lost motion in the valve gear will not cause the lever to vibrate.
745 I have never had any valve rings break at the ports. I have operated engines equipped with slide valves but have never had any valve strips break. Neither have I ever had any parts on any type of valve motion become stuck in the ports or cause any obstruction at all to the steam chest. I have never had my hand slip off of the manual lever, although I have had it slip off of a power reverse, and that was not because it required more strength to handle the power reverse, but by reason of the fact that something had happened to the valve causing the reverse gear to suddenly stop. I have never had a manually operated bar jerk away from me while throwing it over. Such a bar handles just the same all the way from the front position to the back. I have never had

any difficulty in throwing over or handling any manually operated reverse gear except where engines are new out of the shop. I do not see much difference in the way the manual bar handles on the 209,000-pound Mikado engines and the way it handles on other engines. A number of times a link is tight and boxing is tight, also the equalizer is not set exactly right, although I have not had such things happen outside the times when the engines were new out of the shop. I have always been able to adjust the equalizing spring so that it will remain in the proper position. There is, therefore, no difference in the way a small engine handles as compared with a larger engine after they are out of the shop and everything has been broken in.

I have had the air reverse freeze a number of times and reported it each time, although I have never been injured by reason of this freezing and have never had any accident to the train or equipment as a result of freezing except the time that I backed into an engine (T. 2678–2684).

746 On those two occasions I spoke of where the nipple broke I was not injured and both times the reverse lever in the cab remained stationary. On the first occasion I was going 25 miles an hour and on the second one 15 or 20. On neither occasion was any damage done to the engine or train, the only result being blocking all of the street crossings. I have never had any difficulty with a manual reverse engine. When I get an engine new out of the shop and it is stiff I get it fixed up so it will be easy to handle before I move it. I have a new engine now. When I first got the engine it handled stiff and I had work performed on it. The reach rod between the grip and the dog was lengthened because it made the grip handle sit away from the reverse lever. I also had the machinist screw up about an inch on the counterbalance equalizer after which I took the engine and handled her with one hand. Other instances which would cause a new engine to handle hard would be a tight link, a tight box where enough babbit had not been scraped off. I would not have to handle such an engine more than once to find out the difficulty. It might take me 10 or 15 minutes or an hour or six hours to find out the trouble. I would find these difficulties after I left the terminal as there is no way of finding them out while on the passing track. If you put the engine over and she handles hard, then it is necesary to have the fireman assist in handling it and you can then find out where the trouble is. I have had engines where I could not get them over with the bar and had to put a liner in in order to do so. I have never had an engine that I could not handle with one hand after I had had her fixed up. I have never had an engine where the equalizer spring varied. I have never had any difficulty with the dog that goes into the notch of the

747 quadrant, although I have had engines with worn quadrants and have had them where the dog was loose in the quadrant. I have also had them with a loose or weak spring for holding the dog

in the quadrant although this would not have any effect upon the lever. It would make no difference on the locomotive whether the dog fit snugly or whether it was free, unless the dog was worn out, in which case it would be reported. I do not mean it does not make any difference what condition a dog is in (T.2684–2692).

748 F. W. HECK, a locomotive engineer for the Illinois Central Railroad, residing at Chicago, Ill., weight 186 pounds, age 44 years, testified:

I was first employed in engine service on October 5, 1905, and was promoted to engineer July 8, 1917. Since 1905 I have been continuously in engine service, and from February 1924 until September of last year I was traveling engineer.

I have operated all types of engines, both power and manual reverse, in all classes of service, the engines ranging in weights from 72,000 pounds to 178,600 pounds in the case of manual reverse, and from 178,600 to 296,500 pounds in the case of engines equipped with power reverse. At present I am operating in freight service Mikado locomotives equipped with power reverse gear. About 40 percent of my time I have been with manual reverse engines, and the balance with power reverse. It has been about 10 years since I last operated manual reverse. During the time that I operated with manual reverse, I never strained, exhausted or overtaxed myself and always had sufficient clearance in the cab of the engine.

I have never been injured on a locomotive equipped with either a power reverse or a manual reverse. I saw an accident in connection with the operation of reverse gears. It happened on February 29, 1928, with engine 2435, a Mountain type, equipped with Precision reversing gear, which was pulling southbound passenger train no. 3. The train had stopped at a point south of Ashkum on account of a hotbox on the engine. The engine was run up on a wedge preparatory to putting a block between the top of the frame and the bottom of the spring saddle. Because of the ballast, the point was too high to reach, and the engineer climbed up on the rod to reach in between the spokes of the wheel to place the block. The link block
749 which was in the top of the link started down. The motion stopped, but not until it had squeezed the engineer's arm, badly bruising it between the elbow and the wrist. This accident is the same one with respect to which Mr. A. L. Sawyers testified. The engineer was unable to continue on the trip.

I have handled the Ragonett and Precision types of power reverse since 1917, and have operated one about as much as the other. Control with the manual lever is more absolute. With the Precision type, I think it is necessary to make 18 revolutions of the wheel before effecting a reversal, and this takes longer than it does to throw the lever on the Ragonett type. It would take about twice as long to make the 18 turns with the Precision as it would to throw over the hand lever (T. 2692–2700).

It is my opinion that the above-mentioned accident would not have happened had the engine been equipped with the manual gear, for the reason that when you start to reverse a manually operated engine there is a slight movement of the valve motion which would probably be noticeable to you; furthermore, a man handling a manually operated engine would note an obstruction and be very apt to stop when he noticed the obstruction, while with the power reverse gear the obstruction would not be noticeable to him. It is my opinion that if the engine had been equipped with the Ragonett type of power reverse gear, the engineer's arm would have been cut off, and this for the reason that when the engine would have reversed she would have gone over regardless of anything that could have been done by the engineer reversing her. It is my opinion that the manually operated engine is the safer for the reason that wherever you place the reverse lever, there it stays; while with the power reverse gear, if the air should go below the required pressure, the link block would of its own weight drop to the bottom of the link.

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I have never had an engine equipped with manual reverse lever pull away from me after I had unlatched it. I never had a lever jump out of the quadrant and have always been able to maintain a definite and positive cut-off with the manual reverse gear without any difficulty. I have had considerable experience with creeping of power reverse gears, but do not recall at the present time any difficulty with "pumping" (T. 2700–2704).

F. W. Heck, on cross-examination, testified:

I do not think the accident would have occurred if the engine had been equipped with manual reverse. I don't recall at the present time any instance of where I felt an obstruction in the gear while handling the manually operated lever. I do not recall ever having had to exert any special effort in reversing an engine. However, there is a slight exertion at the start, but if you pull with enough strength the lever generally comes all the way over. It is my judgment that it was necessary for the engineer in this instance to have taken the position he did in order to put the block under the engine, as there was no other way of getting the block in. I have never observed anyone being injured by the movement of the link blocks when the air was cut off on a power reverse engine. This instance I have spoken of is the only one in which I have ever seen an engineer in the position that this engineer was in with respect to his arm. The engine in that case weighed approximately 275,000 pounds. I have never operated an engine of that weight. The heaviest engine I ever operated with a manual lever was 72,000 pounds. I do not think that I would have to exert any considerable effort in throwing over a manual reverse on an engine weighing 275,000. I think the effort would be about the same as that on the smaller engine I have operated. Taking the small engine which I have operated, if the position was like it was where this

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accident happened, and if I were in the cab and, having been told to reverse the engine, I started off reversing it and the man's arm was where this engineer's arm was, by the time I became aware that there was an obstruction there it is my opinion that the engineer's arm might have been bruised (T. 2504–2507).

June 20, 1931

GEORGE E. LOSHBAUGH, a locomotive engineer employed by Union Pacific lines, residing at Columbus, Nebr., age 55 years, testified:

I was first employed by the Union Pacific in 1887 as clerk to the master mechanic, started firing in 1898, and was promoted to engineer in 1903. Since that date I have been continuously in service as an engineer. Most of my experience has been on engines equipped with manual reverse. My experience with an engine equipped with power reverse gear was limited to one trip. I have operated engines weighing from 76,000 to 191,000 pounds, mostly in local freight service in which service I have done considerable switching. Most of my service has been in the Norfolk district of the Nebraska division.

All the manual reverse gears which I have operated have been of the lever type. With one exception, I never had the lever of a manual reverse get out of the quardant and go to the corner when I did not want it to. The one exception was when the studs that hold the front end of the quadrant to the boiler sheared off, which allowed the quadrant to drop and the reverse lever to go to the forward corner. That, however, did not put me in any danger. When
752 this happened I was sitting on the seat. I stopped the train but since I was only four miles from a station I proceeded there at full stroke but slow speed. I got hold of some lumber and blocked the quadrant up and worked with the engine for the remainder of the day, doing all my local work. Other than this one instance, I have never had any trouble with the reverse gear in switching service (T. 2708–2712).

I have had occasion to make use of the hand reverse gear for the purpose of braking, as where a brake hanger gets torn off, disabling the driver brakes. In such a case I would use the reverse gear as a brake by reversing the engine and giving her a little steam.

I have never been injured by a hand reverse lever, nor have I ever had one get away from me while either hooking it up or letting it down.

I use the hand lever in switching service in connection with the dropping of cars. Cars are given a start, then the lever is thrown and the engine gets away from the cars. This is found to be more efficient than using the air brake.

I have never had any difficulty in receiving and observing signals in switching service while operating a hand reverse gear. If a signal is changed during the period I am operating the lever, I would know it because I always take a second look before moving.

Timing by a fireman one time showed that it took a fraction over a second for one to throw the lever from full forward motion

to full reverse position. The movement from reverse to forward position would be a trifle quicker than from forward to reverse.

It is quite frequent in cold weather for the oil to become hard on the links and for snow and ice to accumulate there, but I get around any possible difficulty by diluting the lubricating
753 oil with kerosene, and therefore the condition of freezing has never caused me any particular difficulty in handling the hand lever.

In my territory we have bad water conditions, but foaming is prevented by blowing out the boiler and I keep boilers well blown out on engines I operate.

On the locomotive which I am operating I do not see any need for a change in the mechanism of the reversing gear (T. 2712–2715).

GEORGE E. LOSHBAUGH, on cross-examination, testified:

My experience on the light 600, 700, and 800 engines equipped with manual reverse was in the early 1900's. Those engines were equipped with American slide valves. I have been operating 163,000-pound engines for 25 years, equipped with piston valves, and have noticed no difference in the handling of them as compared to the smaller engines with slide valves.

I do not know what caused the studs to sheer off the time the lever went to the corner. The studs are covered up and can't be seen, and quite frequently they crystalize. This is the only instance I ever had of such a thing happening. Pieces of the studs were on the boiler and other pieces were sticking out. The break appeared to be a clean one although there was more or less corrosion around them. I don't know just what is meant by sheared; anyway, the studs broke off. I don't know of any force that would have been exerted on them, running at 30 miles per hour. There is not much force at that point—with the engine hooked up to running position yau can almost any time reach down and unlatch the lever with one hand.

I have felt levers quiver and that is caused mainly by dry valves, and under such a condition if you were to unlatch the lever but
754 let go of it, it would go to the forward corner, because of the pull exerted on it by the valve and the weight. The pull depends upon how much steam you are working, as well as how much steam is against the lever. If you are working heavy there is more pull, and if the valves are dry there is more pull.

When I use two hands on the lever it is because it makes the lever a little easier to handle. I also brace my feet, this for the purpose of making it easier to handle.

The brace I used to seat the quadrant when it broke was very strong, as I had to prevent it from lifting up when I was moving backward; I did not want anything to bend that would unhook my latch down below. If the quadrant had not been thoroughly seated to the deck and held there, the lever would have played around as the engine moved. If I had been attempting to hook up the lever or drop it down and the bolts had broken from the quadrant, I would have let go of the lever, as I would not want to go with it.

In switching service I have had experience in handling the lever with steam in the cylinders in making rapid movements. When I fail to make a coupling the first time, I pull ahead and stop and wait until the knuckles are adjusted and then throw the engine over again, at which time she would possibly have some steam in the cylinders. Every engine that I have had I have been able to throw over with such steam in the cylinders. I have, however, taken two hands to throw the lever in order to make it easier. I use the foot brace in reversing the engine in order to get a better purchase—better leverage and to prevent my feet from slipping. There is a possibility of slipping if one is out of balance. When working in backward motion, with a man on the ground giving signals, I observe him by leaning out of the window. If the man on the ground gives a signal to (T. 2715–2721) go ahead, it is not necessary to come
755 inside of the cab in order to throw the lever. By practice one can throw that lever at all times and keep his head out of the window. With the regular engines the lever handles easily on all occasions. At present I have a regular engine weighing 163,000 pounds, and it is the engine assigned to my particular run that I am talking about. I cannot say that it takes any longer to throw over the lever in the winter time when there are frost conditions than it does when there is no freezing. My statement that it takes just a fraction over a second to reverse the engine does not cover engines just out of the shop. Until you get such engines loosened up, it takes longer. As a rule, engines just out of the shop cannot be handled with one hand, because everything is new and tight.

I could not estimate how often the air brakes could not be used. I have not reported such brakes inoperative within the past five years. However, in May 1928 I had the main brake hanger on the engine come off, and reported it at Columbus. Such an accident never happened before that I can remember. A good many years ago, in the 1890's, I had an engine break her pipe off under the deck, and I used the lever to brake. These are the only two occasions that I can recall where I had an air-brake failure. My statements are made on the basis of my experience throughout my years of service (T. 2721–2726).

756 W. S. Beach, a locomotive engineer employed by the Union Pacific Lines, residing at Grand Island, Nebr., age 54 years, testified:

I was first employed by the Union Pacific in 1891 in shop work, and began firing in 1897. I was promoted to engineer in 1902, since which time I have been continuously in service as an engineer. I have operated engines ranging from 76,000 to 191,000 pounds on drivers, but mostly in local freight service, in which service there is considerable switching to be done.

I have operated engines with slide valves and also engines with piston valves. I have operated engines equipped with the Stephenson gear, as well as the Walscheart. I have never had any experience

with power reverse gears. My experience with the hand reverse has all been with the lever type, and I have never been injured by the hand reverse. I have never had a lever get out of the quadrant and go to the corner, or seen that happen, nor have I ever had a lever get away from me while hooking up or letting down. I never had a hand lever pull me to the corner with it, nor ever seen any danger in handling such a lever. I have never had to have any help to operate the hand lever. If I am switching ahead I usually use one hand to throw the lever, while if I am working backwards I usually stand up, sometimes handling the lever with one hand and sometimes with two. I have never had any difficulty in getting or observing signals while switching. I have never been exhausted or strained from operating the lever.

I had one experience where I used the hand lever for braking purposes, and that was the case where the spring hanger broke, letting the equalizer up and breaking off the main reservoir pipe to the air pump. This made it necessary to brake the train with the lever.

757 I have never had an engine failure due to any trouble or difficulty with the hand reverse lever, and I do not consider that there is any danger in connection with handling the hand reverse lever on the engines with which I have had experience (T. 2726–2732).

W. S. BEACH, on cross-examination, testified:

Most of my experience, or at least 50 percent of it, has been with engines weighing 163,000 pounds. At the present time I have a regularly assigned engine, which I have had for at least 15 years. There is practically no difference in the amount of strength that is required to throw over or handle the reverse gear on the light engines and that required on the present type of engines. The present engines are equipped with the Walscheart motion and piston valves, and I do not notice any particular difference between the slide-valve engines and the piston-valve engines. In local freight service I usually run at a speed of about 30 miles an hour. Some part of the time in local freight service is consumed in switching and during that time I almost always work the lever in full forward or full backward position. In local freight service there is occasion for hooking up the engine when moving from one station to another. In hooking up or dropping down an engine, I do not get any play. If you were to disengage the latch from the quadrant, and let go of it, it would catch in the first notch and would have a tendency to go ahead if it was ahead of the center, and this because of the weight of the link block. The lever handles harder where the valves are dry. If the valves are dry and it becomes necessary to move the lever, I would first ease off on the throttle, although I prefer to handle the lever when the valves are lubricated because it handles easier.

758 In cold weather when the links have frost on them, the lever is harder to handle; and when the engine is new out of the

shop, it is harder to handle. I have had experience with insufficient lubrication in the valves. I had only the one case where it was necessary to use the hand-operated lever as a brake (T. 2732–2737).

W. S. BEACH, on redirect examination, testified:

I have charge of the lubrication of my engine, and if I have a dry valve I open my feeds to the lubricator and it would only take four or five minutes for the lubrication to work down into the valves. On my engine I have a hydrostatic lubricator (T. 2738).

JOHN AITA, a locomotive engineer employed by the Union Pacific, residing at Council Bluffs, Iowa, age 47 years, testified:

I was first employed by the Union Pacific in 1902 as a fireman on a wrecking train and started firing a locomotive in 1906. I was promoted to engineer in 1914 and have been continuously in service as an engineer since then with the exception of two short periods when I was set back to firing, which periods combined would not exceed six months. My experience has been principally in yard and through-freight service, and I have operated locomotives equipped with the hand reverse as well as those equipped with power reverse.

My first experience with power reverse occurred about 1922, previous to which time I have operated hand reverse gears exclusively of the lever type, weighing from 76,000 to 191,000 pounds on drivers. Since 1922 my experience has been entirely with power reverse. Between 1914 and 1922 while I was using the hand lever I was never injured thereby nor did I ever have it get out of the quadrant and go to the corner. I have never been kicked, jerked, or strained
759 in any way by that lever, nor have I had it get away from me while hooking up or letting down. The experience with the hand lever was mostly in switching service in the yards. Handling the hand lever in switching service, if working ahead, I would place both feet in front of me and use my left hand on the throttle, the brake valve and reverse gear; but, if working back, I would straddle the seat and use my right hand on the throttle, reverse gear and brake valve. I have found but few hand levers that I could not operate with one hand, and on one occasion it was necessary for me to obtain assistance in order to move a lever of that type. That was a case where I was taking an engine out that had just been overhauled, and the valve stems broke within a half mile of the roundhouse. I have never had any trouble in handling the hand lever due to freezing.

The first engine I had equipped with power reverse was a Mikado type, 2–8–2, weighing 214,050 pounds on drivers. I have also operated the Santa Fe type, 2–10–2, weighing 295,000 pounds on drivers, equipped with power reverse, as well as the Union Pacific three-cylinder locomotive of the 9000 class, 4–12–2, weight on drivers 355,000 pounds, which was, I think, equipped with an Alco power reverse gear.

I have had difficulty with creeping where the engines were equipped with power reverse gears. In some cases they would go part of the way over the road and the cut-off would be at a fixed point, and then they would begin to vary and the farther I would go the more it would vary. In fact I had two engines where it did not creep but just wandered, and by wandering of the power reverse gear I mean that they traveled from the desired point of cut-off to the full-valve travel, back and forth. That happened twice within the last year.

The first time it happened I was going about 38 miles an hour and I was compelled to ease off on the throttle for fear
760 the engine would damage herself. This wandering disturbed the slack in the train, causing it to move roughly, and this rough action in the train was called to my attention by the conductor. I, however, told him that I was unable to avoid it.

On the second occasion I was about a third of the way over the district with a good reverse gear. Then it started to creep and continued to get worse, and when about half of the way over the district it started going back and forth the full travel of the valve and continued to do that until I arrived at the end of the district. This caused me to make an extra stop for water and to burn from three to four tons of coal more than ordinarily required for that run. The run over the district was 147 miles, and I probably lost an hour on the run (T. 2738–2746).

On the first occasion which I have mentioned I noticed a difference as to the consumption of coal and water. I had to make an extra stop for water, causing a delay of 15 to 20 minutes, and the engine did not handle the train at the speed she handled it previous to the creeping. I think the engine was equipped with a Ragonett gear.

One of the occurrences was within the last three months. I do not know how old the gear was. When this creeping condition arises an engineer tries to overcome it by moving the lever at times, and this gets his mind off of the block signals.

I had an accident caused by power reverse gears at Fremont, Nebr., on September 23, 1930. There is a passing track at Fremont about a mile and three-quarters long, in the form of an S-shaped curve. The eastbound passing track is to the south of the main line, which is double-tracked. There is a cross-over at about the center of this passing track, and one at the west end. I was oper-
761 ating a late fruit train of about 60 cars and came up behind another train that was standing at the east end of Fremont, and stopped possibly 10 car-lengths behind it. I got down on the ground and screwed down my grease cups and oiled the engine as I did not intend to make any more stops. As I was filling the guide cup I heard a loud report and discovered the steam pipe to the air pump had broken off where it entered the air pump. I examined the nipple and found no threads on it. That necessarily

put the pump out of commission. It (T. 2746–2750) was decided to consolidate the two trains. I moved my engine up and took the caboose off the train in front of me. I backed over the cross-over so the other engineer could move his train back and couple to the one I had been pulling. I was to put the caboose on the rear of the train and then go ahead to the end and double-head in behind. That is, I was to go up the passing track to the head end of the train. Although the air pump had failed I had some air, but this move required more air than I had figured on. As the air pressure was getting low, I decided as a matter of safety to cut the steam in to the power reverse gear so I would have something to control my engine with in case I needed it. At the time I did this I was in the rear of the train, about one-half mile. I proceeded down the passing track and as I was nearing the caboose on the train, the conductor asked me to slow up a bit to let him off. I reversed the engine with the reverse lever and gave her a little steam to drop down to about six miles an hour, and he got off. I then reversed the engine into forward motion and started for the head end of the train. I started toward the head end at a speed of about 15 miles an hour, but one of the trainmen had forgotten to line the switch from the passing track to the main line, and

762 the two trains were coupled up and standing across the cross-over. The switch had no light on it, but I had a good headlight, it being about 9:30. Seeing the target on the switch was red, I tried to reverse the engine but could not budge the lever. I gave a yell, and the fireman and brakeman jumped. I was still trying to reverse the engine but I hit the train, turning over two cars and tearing the side out of another one. I understand the property damage amounted to about $3,000. The train I ran into was on the fireman's side. If the engine had been equipped with hand reverse gears, I could have stopped it by using the hand reverse for a brake.

Based upon my experience, my opinion is that the hand reverse is the safer (T. 2750–2756).

JOHN AITA, on cross-examination, testified:

I am a member of the engineers' brotherhood. I have never been strained, or overtaxed, in the handling of a manual reverse lever; it does not take much strength to handle them. I have used mostly engines weighing from 76,000 to 190,000 pounds in the yard service. A 76,000-pound engine is known as a light one while the 190,000 is known as a heavy one. I have never noted any instance when the lever handled harder than usual, when switching in the yard.

I have had only two or three instances, when engines were new out of the shop, when it was necessary to use two hands to throw them over. Unless they were new out of the shop I could always make a rapid reverse, and with steam in the cylinders, using only one hand, and that with the 191,000-pound engines. These engines have a foot brace, which I use only for convenience and to keep my

balance. As the position of the lever when it is up near the center has nothing to do with the necessity for bracing, I do not find it necessary to brace myself. The amount of pull on the lever is about the same as though you were lifting 10 or 15 pounds.

763 On the occasion that I referred to where I had to get assistance, I called the fireman, and both of us together were able to pull the lever. This was due to the fact that the engine had just been overhauled and we were breaking her in. It had new valve cages and new valve rings and they were tight. Both valve stems broke, after which we handled the lever just to see what difference there was—that is, to see what would happen—and you could just toss it either way.

I have had a little experience with the valves getting dry in road service, but none in yard service. I never noticed the lever working harder when the valves were getting dry (T. 2756–2762).

"Q. Do you think you could handle one of these Union Pacific type locomotives with manual reverse?

"A. I couldn't say. I never tried it.

"Q. Is it your judgment that the 76,000-pound engines handle about the same as the 191,000-pounds engine?

"A. Yes, sir.

"I have formed no opinion as to my ability to reverse either the Union Pacific type or the Santa Fe type weighing 295,000 pounds" (Rec. 2762–63).

On the occasions when the power reverse creeps there are times when it comes back of its own motion; it will go down a ways and come back by itself. Creeping mostly occurs when the lever is well up towards center. If you drop the lever down a notch or two, that gives more stroke but does not overcome the creeping when the cut-off is relatively short. The creeping might stop by working full gear, but I have never noticed it in starting a train, although I have noticed it plainly after the train was in motion and the lever hooked back.

764 On the occasion of the accident at Fremont I was handling a Mikado type locomotive weighing 214,050 pounds, and if that locomotive had been equipped with a manual reverse I could have avoided the accident by reversing the engine. As to whether I could have done the same thing if I had had a 295,000-pound Santa Fe engine—that would depend upon whether I could get that size engine over, but I think I could.

I have made complaint every time a power reverse gear did not function properly, but according to my recollection have never made one to the brotherhood committees. During the past three months I have possibly filed two work reports on power reverse.

On the occasion of the wreck I handled the locomotive after the collision and reversed it, but it took me 10 minutes and it took me another 10 minutes to reverse it back. I pulled on the lever and moved it about three notches and latched it and let it remain. Then after getting my wind I pulled on it again and got about three or

four more notches. I had both feet braced and pulled for all I was worth, but I do not know what was wrong with it. One foot was braced against the boiler and the other against the window frame, and both hands on the lever. The accident was investigated but I was not disciplined in any way (T. 2762–2769).

765 ALANSON BEACH, a locomotive fireman employed by the Union Pacific, age 30 years, testified:

I was employed by the Union Pacific as a fireman in 1922 and have since been continuously so employed. While I have not been promoted to engineer, I have had experience in operating engines and have operated them equipped with manual reverse as well as with power reverse. I have fired on both manual and power reverse equipped engines and have done that in road service, although most of my experience has been in yard service. Insofar as power reverse is concerned, my experience has been with the Ragonett type of gear.

I have never been injured by a hand reverse gear. I have never had a hand reverse lever get away from me, nor jump out of the quadrant and go to the corner. I have never been called upon by an engineer to help handle a hand lever, except on a new engine, that is, an engine which was being broken in.

I have observed the power reverse gear creeping on engines which I have fired in road service. I knew the gear was creeping by the action of the fire. A creeping gear tears holes in the fire and causes excessive drafts, and on such occasions I would call the engineer's attention to it, and he would tell me the gear was creeping. This condition would cause an excessive use of coal as well as water. I recall many occasions with creeping gears where it was necessary to make an extra stop for water.

I had an accident at Council Bluffs with a power reverse gear equipped engine. On that occasion I went to the roundhouse to get an engine of the 1900 class. It was headed in towards the wall. There was a counter between the wall and the engine about which people worked. The engine was under steam. There was a man working under the tank. He came out and said he was through.

766 I got into the cab, examined the water and air. The air pressure in the main reservoir was 90 pounds, and the steam pressure was about 195 pounds (T. 2769–2775).

The reverse gear was on center and I put it in back motion and opened the throttle, but the engine did not move. I then shut off the throttle and made an investigation. Everything seemed to be all right, so I opened the throttle, but the engine still would not move. I proceeded to put the reverse lever on the center and when I did that the engine went forward with her cylinders full of steam and full boiler pressure. I immediately put the automatic brake valve in emergency, but before I could stop, the engine had torn down the roundhouse wall. Just as the engine started forward, I noticed two men passing in front of it and as soon as I stopped I immediately got down to see if they had been caught by the engine. But they were safe. On the other side of the wall which was torn

down was a tool room, in which men worked, but at this time there was only one man in there and he was not near the scene of the accident.

My purpose in moving the reverse gear to center was that I was going to get off the engine and see if I could locate the difficulty. (It was developed that the damage amounted to about $500.) An investigation was made in connection with the accident, but I was not disciplined. I don't see how the accident could have happened if the engine had been equipped with the hand reverse gear (T. 2775–2778).

ALANSON BEACH, on cross-examination, testified:

The accident occurred in 1928, and I had been operating power reverse engines since 1922. When I got on the engine the first thing I did was to examine the water in the boiler and then the air and steam pressure, after which I got up on the seatbox, put the reverse lever in back motion, which I had found on center,
767 and I then opened the throttle a little. I noticed that the air mechanism moved into back motion when I put the lever in back motion. I don't know whether the valve gear moved when I put the lever in back motion, as I could not see. I did not observe the crosshead of the reverse gear as it was under the running-board and hard to see. I know the gear operated by the exhaust of the power reverse gear. I did not examine the link motion or know whether it operated when I pulled the operating lever into back motion. At the time of the accident there were no instructions relative to testing reversing mechanism before giving the engine steam and there are none now; and if I were to go on a locomotive today with power reverse, I would do the same thing as I did at the time of the accident—I would pull the lever into back motion and if I heard noise like escaping air then I would give it steam without making any further inspection. That is proper practice on my road.

Considering all of my service, I could not tell how much time I have spent in road service, although I could say that I have easily spent a quarter of it in that service, principally on through freight, operating between Council Bluffs and Grand Island, a distance of 147 miles.

It is in that service that I have had holes pulled in the fire by reason of creeping power reverse mechanism. The running time varies, but on one of our through freights it is about eight hours. With respect to the accident I referred to, I do not know what was done with the engine or what repairs were made on it. I did not see it again, as the district foreman immediately relieved me of that job. He said, "That will be all. You can go home." I was off until the next morning at eight o'clock, when an investigation was held, which
took about 30 minutes. Then I was called for the switch
768 engine. This accident occurred on my first and only day of hostling.

On the through freights that make 147 miles in an average of eight hours, the Mikado and Santa Fe types of engines are used, the Mikados weighing 214,000 pounds and the Santa Fe type being heavier. The trouble that I had was with a Mikado hand-fired engine. I do not know the coal capacity of the tanks of those engines. The water capacity is 10,000 gallons on some, while on others it is 9,000. I have made this run on Mikado engines with the power reverse functioning without any difficulty. On such trips I would have gotten the engines either at Council Bluffs or Grand Island, at which points they would be loaded with coal and water. Between Council Bluffs and Grand Island, coal is taken at two points, Valley and Columbus, and the amount taken varies according to the train. We are never given a report as to the amount of coal we take on. We start with a full tank; but as to how much is taken at Valley and Columbus, I don't know, as the coal chute attendant fills out the ticket. The amount of coal used will vary with the weather. To the question, "To what extent may it vary with the weather conditions, say, the wind conditions, etc.? How much variation will you have with a similar kind of train, a tonnage train, due to weather conditions?" the witness replied, "Three or four tons of coal, I imagine." I do not know the average consumption of coal on the trip with the tonnage train. I arrive at the conclusion that I would have a variation of three or four tons due to the weather by the number of fires I have to put into the fire box. I do not know how many fires I put in with the tonnage train over this route, nor do I have any idea (T. 2778–2787). My statement relative to using three or four more tons of coal is based upon the appearance of the coal pile and what is left in the tank.

769 Leaving Council Bluffs with a full tank of water, we take on water at both Valley and Columbus. The distance from Council Bluffs to Valley is 28 miles, and I believe Columbus is 85 miles from Council Bluffs. There are other places to take water along the line between Columbus and Grand Island, but a stop is never made there except in emergencies. It was last fall that one of these emergency stops was made because of having a creeping power reverse. I do not know the name of the engineer on the engine at that time, as I seldom get the same engineer twice and it is very hard to keep track of them. I do not remember the names of the engineers nor the occasions on which I have reported creeping gears. Two or three trips may be made where the power reverse gear will creep, and then I may go along for a month or two without having it creep. This creeping happened on an engine I was on last fall, but I do not remember the names of the engineer nor the date. I, myself, make no reports of those occurrences.

On my road we have fuel conservation instructions, but I have never attended a fuel conference. When I would call an engineer's attention to creeping gear, he would say he would not forget to report it. I do not remember the names of the engineers that I

spoke to with respect to creeping gears because I never have the same engineer again.

I have had trips where I know I burned much more coal with the creeping valve gear than I would have burned without it, but I do not recall any particular trip on which that happened. There is a system on my road whereby records of fuel consumption are published, but I don't know whether the records are those of good firemen or poor firemen. I don't know for what purpose the company puts out the report. I have never had an official call my attention to the amount of fuel I had used on any trip. No
770 one ever asked me why I burned more coal on one trip than on another. There is a fuel supervisor on my division, or there was last fall (T. 2787–2796).

ALANSON BEACH, on redirect examination, testified:

I imagine there are around 300 engineers on my district and it frequently happens that I make a trip with one without knowing his name.

In connection with the investigation of the accident I had, the machinist was disciplined for leaving a pin out of the crosshead on the power reverse gear reach rod. I know that because it came up in the investigation. Leaving the pin out would have no effect on the reverse gear. In such a case, if the lever was pulled back, the reversing gear would sound normal. The piston would move but it would not move the reach rod. I figure that the reach rod dropped down and the space between where the pin goes in at the end of the reach rod struck the crosshead, and this would move the gear forward enough to let it go down to the corner. If this pin had been left out of the reach rod, in similar fashion, on a hand reverse engine, I could have detected it when I undertook to handle the lever.

It would have taken a very close inspection for me to have found that this pin was out. The pin might have been out and the reach rod up in place in the crosshead or it might have been down (T. 2796–2799).

ELMER HOLMQUIST, master mechanic employed by the Chicago and Northwestern Railway Company, residing at Oak Park, Ill., age 53 years, testified:

I was employed as locomotive fireman in July 1898, and
771 was promoted to engineer November 1902, to road foreman of engines October 1916, to assistant fuel supervisor November 1918, to assistant master mechanic June 15, 1922, and to master mechanic September 1924. At the present time I am located at Chicago, Ill., and have under my jurisdiction the Wisconsin division.

As road foreman of engines I was on the northern Iowa division; as assistant fuel supervisor I covered all of the divisions west of Chicago; as assistant master mechanic I was located at Antigo, Wis.,

and as a master mechanic I was at Eagle Grove, Iowa, two years, before coming to Chicago.

The Wisconsin division covers Chicago to Fond du Lac, Wis., 147 miles, Chicago to Janesville, Wis., 91 miles, and Kenosha to Rockford, about 70 miles. The Chicago to Fond du Lac line runs up the lake shore through Milwaukee.

There were no power reverse gears on the northern Iowa division while I was employed there as engineer. While I was assistant fuel supervisor and until the present time, I have had occasion to ride engines frequently and operate them, equipped with both the hand type of lever and the power reverse. While serving in the capacities of assistant master mechanic and master mechanic, I ran engines equipped with both types of gear. My experience is that the power reverse gear requires more maintenance than the hand reverse and is also unsatisfactory from the standpoint of control of the cut-off of the valves at times; also, when engines are standing in the roundhouse or on the ready track, there is a possibility of movement of the power reverse gear, which does not happen with the other type. I have also found that there are reports made on power reverse gear more often than on the hand reverse. The power reverse will not maintain a fixed point of cut-off at all times when on the road,

772 whereas the hand lever will usually stay where it is put. I have never experienced any difficulty with maintaining a fixed point of cut-off with the hand lever. I know of three cases where, due to the failure of the power reverse to maintain a fixed point of cut-off, the locomotives have reversed themselves, the drivers have locked and slid. These are the occasions testified to by witnesses Summers, Herrick, and Olson in this case. On two of the occasions, the expense involved was about $300 each.

I have never been injured or observed any injury due to the operation of the hand reverse lever. To my knowledge there has never been any screw-type hand reverse gear on the North Western. I have never experienced or observed any occasion when the hand reverse lever pulled or got away from the man operating the engine, or where such a lever became unlatched of itself and moved down into the corner. You can detect the condition of dry valves by the rattle of the hand lever, but with the power reverse gear it cannot be detected by such action of the lever. When the valves get very dry, you can detect it by the exhaust of the engine. If you detect it by the hand lever, it is possible to take action to overcome the trouble, or at least see where it is and perhaps prevent a break-down. I can account for the fact that some of the engineers who have been running many years have dry valves, because there are some more careful in handling water than others—some blow their engines out better than others.

The purpose of the two types of reversing gear is to enable one to reverse the engine and run in either direction and to control the point of cut-off. With the power reverse gear, the power required to reverse the engine is furnished by compresed air instead of mus-

cular power as in the case of the hand lever. Either one of
773 these devices is a necessary part of the operating mechanism of a locomotive, but I do not consider either of them a safety device. I would say that manually operated reverse gears and power reverse gears in good condition are both safe to operate (T. 2799–2805).

If the hand reverse lever becomes unlatched and goes to the corner, it will have a tendency to go in the direction in which the engine is moving, and this does not endanger the engineer. If the lever goes into the forward corner it usually goes away from him, and if it goes into the back corner—back-up movements are usually made at low speeds—the lever being located alongside the engineer, there is not much possibility of his becoming injured. With the hand lever the engine will always move in the direction indicated by the position of the lever in the cab, whereas with the power reverse gear this is not always the fact as we have occasions where the engine will move in the opposite direction from that indicated by the lever in the cab, as in the case of the power reverse gear engines going through the roundhouse walls. A hand operated lever will not move unless moved by someone, whereas the power reverse gear has been known to move without action on the part of anyone, and this has taken place at times while pumping up the air pressure. This is in reference to engines standing still. The movement of the power reverse gear without action on the part of anyone creates the possibility of the engineer or others working about the machinery being injured. I do not consider that the safety of a locomotive is promoted in any way by the application of a power reverse gear. That type of gear is more expensive to maintain and is less accurate in holding the valve gear at the desired point of cut-off. The creeping of the power reverse results in waste
774 of fuel, by changing the point of cut-off without action on the part of the engineer and also causes undue strain on the valve gear parts and machinery when this change takes place at high speed.

When a hand lever becomes unlatched it does not necessarily follow that it will go to either one corner or the other, as it might latch itself and not move very far. When I say that the hand lever will usually stay where it is put, I have in mind that when you place it in position on the quadrant it will stay there. I use the term "usually" because I have heard of cases where it did not stay in the position in which it was placed, although I have never experienced or observed any. I make it a point to check work reports periodically to get an idea of how the work runs, what is being reported, how the work is being done, in order to keep the engines in as good shape as possible. During the month of May an examination was made of 2,872 work reports, out of which were found 44 reports on reverse levers, 30 on power reverse gears, and 14 on hand reverse. I have had other occasions to check work reports. Upon instructions

from the assistant superintendent of motive power I checked the work reports on some Pacific type locomotives equipped with power reverse gear and a couple of Mikados equipped with power reverse during the period from October 10, 1930, to February 17, 1931, and found 27 cases where the engineers had reported reverse gears creeping and other defects in them. The purpose of that check was to ascertain the amount of trouble and the cost of maintaining power reverse gears. The reason these particular locomotives were selected was because there seemed to be more trouble with them than with others. These locomotives were equipped with Barco gear. A memorandum of the result was made, which I have with me. (The memorandum referred to was offered in evidence as exhibit
775 no. 35.) The reports (T. 2805–2810) from which this information was taken show what work was done. (The document was received in evidence and marked "Defendants' Exhibit No. 35.") The report was not made up in connection with this case, and I had no knowledge of this case at the time this check was made. The work done as a result of these reports was not by a regularly assigned power reverse specialist, but by a machinist working on running repairs. There is a specialist for air. I don't know whether a specialist for power gears would help any or not. Injectors are all taken care of by a special man in the back shop. I think the machinists that work on the power gears have been in contact with the service men of the manufacturers of the gears. We had a service man from the Barco reverse gear company make a trip on one of the engines, but I did not see his report or know what he reported. After that there was one little change made on one particular engine; the set screws that control the thrust bearing worm in the Barco reverse gear were taken out and shims put in. That was done a few days ago and I do not know the results. Previous to this we had service men ride engines a few times, but they never seemed to do very much good. Our troubles were not overcome. If the Commission should require that some or all locomotives be equipped with power reverse, I suppose that the new and latest gears would be installed (T. 2810–2814). To the question, "Suppose the best known gears manufactured today were put on, to what extent, if at all, could we reasonably expect the same trouble out of these new gears as these various witnesses that have testified have been having with the gears now on existing engines?" the witness replied, "Well, I would answer that by saying that they have not been perfected yet to the extent that they will hold the valve gear in proper position at all times." The newest engines in service with which I am ac-
776 quainted are the "E–'s", which came 2 us in about 1926. I do not know whether, for instance, the Barco gears that are manufactured today have any changes over those on the engines which came to us in 1926. Class "H" engines were purchased, I think, in 1929 and they are equipped with Alco gears, and I think such gears were the latest type at the time the engines were bought.

On engines equipped with power reverse gears, the air operating mechanism is located on a bracket studded to the boiler. It varies a little in height on different classes of engines, but it is high enough to be reached from the ground. It is below the running-board (T. 2814–2818).

June 22, 1931

JAMES F. WELLS, a machinists' helper employed by the Chicago, Rock Island and Pacific Railroad, residing at Booneville, Ark., age 40 years, testified:

I was first employed by the Chicago, Rock Island and Pacific Railroad on January 12, 1923, as a roundhouse laborer, and was promoted to machinists' helper June 1, 1928.

On August 22, 1930, at the Booneville, Ark., roundhouse a machinist by name of Garrett was killed while working on locomotive no. 2136, and which was equipped with an Alco power reverse gear. I was helping Mr. Garrett and it became necessary to move the locomotive into position over a pit so that we could work on it. This was the first time the engine had been used at Booneville since being equipped with power reverse. I got on the engine to move it, but there was not sufficient air pressure to reverse it, so I started the air pump. Mr. Garrett came back to me on the left side of the engine and asked if the engine did not have a hand reverse. I told him we would have to wait a few minutes until there was sufficient
777 air. As soon as I had sufficient air pressure I gave the back-up signal with the whistle. He called to me to stop when I had gotten far enough back. I stopped, put on the brakes, put the reverse lever on center, and shut off the pump. I then went down the left side of the engine where the machinist was and spoke to him. He did not answer. I then saw his neck was caught between the valve stem guide and the radius rod. I called for help, which came. I told a hostler to get into the cab and move the reverse lever so as to release the machinist. The body was released and laid on the ground and a doctor was called, who pronounced him dead.

I think Mr. Garrett, the machinist, was looking at the cross-head pin. He knew that I was going to back up and before I reversed the engine I gave the usual back-up signal with the whistle (T. 2819–2824).

I did not experience any difficulty in moving the reverse lever from the backward position to center and was not aware that there was any obstruction between the valve stem guide and the radius rod. I was not disciplined by reason of the accident.

JAMES F. WELLS, on cross-examination, testified:

The machinist was caught between the valve stem guide and the radius rod. When I got out of the locomotive after putting the lever on center, I thought he was all right, in fact I thought he was inspecting the engine. When I had reversed the locomotive far enough, Mr. Garrett, the machinist, called out, "That will do."

The only thing I did after that was to move the reverse lever from back position to center and shut off the pump, and then to come down off the engine. He must have been caught after the engine was stopped. It was less than a minute after stopping the engine that I put the lever from the reverse position to center. This
778 instance was the first time I had used power reverse. I do not know what Mr. Garrett was inspecting or looking for, as there had been nothing reported by the engineer (T. 2825–2829).

A. C. McGuire, residing at Booneville, Ark., employed by the Chicago, Rock Island and Pacific Railroad Company as general foreman at Booneville, testified:

I was first employed by the Rock Island on June 22, 1913, at Brinkley, Ark., as a foreman, and have also served as foreman at Memphis, Tenn., Alexandria, La., El Dorado, Ark., and Booneville. I have been employed as general foreman at Booneville since June 15, 1930, and recall the accident which occurred at the Booneville roundhouse on August 22, 1930, as testified to by Mr. Wells.

I was not present at the time of the accident but was notified of same and immediately went to the roundhouse and investigated the circumstances whereby Mr. Garrett met his death. I arrived at the roundhouse about five minutes after I was notified of the accident and found Machinist Garrett lying on a cot in front of the roundhouse office. There were present the night foreman, company physician, and several other employees. Shortly after I arrived another physician arrived, as well as Mr. Garrett's wife. Mr. Garrett's duties as machinist were to inspect engines and to do the necessary work on them, and according to the investigation which I made, he was performing his duties at the time of the accident. He had been hired as a machinist sometime in 1924 at Alexandria, La., and was transferred to Booneville in May 1928, at which point he was continuously employed as machinist until the time of the accident. It is my duty as general foreman to make investigation of all
779 accidents at the Booneville terminal in the mechanical department, and my investigation disclosed the same facts as related by Mr. Wells.

I measured the distance between the radius rod and valve guide bar when the reverse lever was in backward motion and found it to be 8¾ inches at the closest space and 11 inches at the widest. I also measured the distance between the radius rod and the valve guide bar when the reverse lever was in center position and found the closest space to be $3\frac{3}{16}$ inches. These measurements would have been no different if the engine had been equipped with hand reverse (T. 2829–2834).

I have seen a man caught between the reverse gear and other parts of the locomotive when such locomotive was equipped with a manually operated reverse gear. That was shortly after the shopmen's strike in 1922. A passenger engine was being prepared to go out on its run. The engineer was oiling the engine, and the fireman and I were present. I was standing on the right side of the engine, near

the engineer, and was 3 or 4 feet from the engine and about 14 feet from the fireman, who was in the cab on the right hand side. I heard the engineer tell the fireman to put the engine into forward motion. As the fireman placed the reverse lever in forward motion, the engineer, looking over into the valve motion or some part of the mechanism of the engine, placed his head between the tumbling shaft upper lift arm, in front of the tumbling shaft lift arm, and between that and the back end of the front driving spring. As he did this, the fireman moved the reverse lever in forward motion. There was a space of about a foot in which the engineer placed his head. The lift arm caught the engineer's head between itself and the driving spring, and as that happened the engineer hallooed.

Almost simultaneously the fireman moved the reverse lever
780 back again and the engineer got up with blood trickling from his temple and face. He stated that he did not believe himself to be very badly hurt. I went into the washroom with him, washed the blood from his face, and examined the wounds on his face. As he decided he was not hurt seriously enough to call a doctor, he went back and finished the preparations on his engine and went out on the run. The moment the fireman pulled the reverse lever back, he jumped off the engine, rushed to the engineer, and made the remark that he felt the obstruction, felt him when he caught his head. No report was made of the accident (T. 2834–2839).

A. C. McGuire, on cross examination, testified:

The place at which the engineer was caught on the manual reverse engine was not the same as the one on the power reverse engine, nor was it on the same side. I do not think the fireman on the hand reversed engine was in a position to see the engineer, because the engineer in such a case would be under the running-board and the fireman's position would be over the running-board. On the occasion of the accident with the manual reverse gear, the fireman went out on the run.

The reason why a machinist would put his head between the valve stem head and the radius rod would be possibly to examine the pin collar or some part of the locomotive. I would hesitate about putting my head in there, as there is danger in putting your head or arm any place in between the moving parts of the valve motion. In connection with the accident on the manually equipped engine, the end of the driving spring just cut the skin enough to make it bleed. The skin on the left side of the engineer's head was not broken, and it was less than an hour afterwards that he went out on his run. At the time of this accident there was no other official present be-

sides myself. I could have said that he should not go out on
781 the run but after he said he was all right I did not object.

The locomotive in that instance was a little eight-wheel passenger, weighing about 110,000 pounds on drivers—it was one of the 500 class. The lever was in the center of the quadrant when the engi-

neer told the fireman to throw it forward, and the fireman got the lever about halfway down to the corner before the engineer hallooed that he was caught.

In moving the lever forward from the center position to full forward motion with the engine stationary, there is very little tendency for the bar to pull forward on account of the weight of the links, because there is a counterbalance spring to take care of that, and I would say there is no danger at all in this when the counterbalance is in good condition. In fact, a little pressure must be applied to push the lever into the corner, and it would be my opinion that the fireman was pushing on the lever slightly at the moment the engineer's head was caught. The lever can be operated with one hand. It is true that although there was only a slight cut on the engineer's head, the fireman stated when he got off the locomotive that he felt an obstruction. There were no marks on the other side of the engineer's head, due to the fact that the lifting arm was smoothed off on that side, whereas the side that caught him was rough, as the lift arm where the reach rod connects to it is smooth and he shoved his head against the end of the spring. Although the engineer's head was not in any greater distance than would give him a slight wound, nevertheless I do not have any reason to doubt what the fireman said with respect to feeling an obstruction (T. 2839–2846).

IRA C. WALLACE, residing at Middletown, N.Y., age 60 years, employed by the New York, Ontario and Western as a fireman, testified:

782 I was first employed by the New York, Ontario and Western in 1892 and was promoted to traveling fireman about 1906. My duties as such were to break in overhauled engines and get them ready for road service. I held the position of traveling fireman in 1916, at which time engine 356, which had been overhauled in the back shop, was run outside the shop and fired up. It was my duty to get the engine ready for road service—that is, limber her up. I oiled the engine, got into the cab, and was filling an oil can when the engine started to move forward about 100 or 150 feet, killing one man and seriously injuring two. I tried to stop the engine by putting the brake valve in emergency and reversing, but did not have any air. Seeing that I could not stop her in that way, I thought I could stop her by blocking, so I jumped down and looked for a block but there was none. I could not get back into the cab, because the engine was going into the shop and the clearance between the cab and the door was not sufficient. Therefore I ran around to the other end of the shop and got on the engine there. Just as I ran around to catch the engine I observed a man crawling out, but I did not know whether his leg was cut off or crushed. The engine was equipped with the Ragonett type of reverse gear.

Prior to the time the engine moved, I did not move the throttle, nor did anyone else to my knowledge. I have had experience in operating engines equipped with both hand reverse and power re-

verse, and if this engine had been equipped with hand reverse, I could have stopped her. When I put the brake valve in emergency there was no air, as the air pump had not been started, because the engine was being overhauled and had not been "O.K.ed." I had examined the throttle and found it shut (T. 2847–2851).

783 IRA C. WALLACE, on cross-examination, testified:

The first thing I did when I got the engine was to oil it and then get into the cab and fill an oil can. The cause of the engine moving was a leaky throttle. I had not made any observation of the air gauge, but I think I had about 160 pounds of steam. The engine was of the 2–10–2 type, weighing 292,000 pounds on drivers. I have never operated a locomotive of that weight with a manual reverse. (An accident report filed with the division of locomotive inspection was offered and received in evidence, and marked "Defendants' Exhibit No. 36.") (T. 2851–2853.)

784 H. S. RYDER, residing at Middletown, N.Y., age 56 years, employed by the New York, Ontario and Western Railway as road foreman of engines testified:

I was first employed in 1895 and was promoted to road foreman of engines in 1924. I have had experience in operating both hand and power reverse gears, having first operated a power reverse gear in 1915. I have had experience with the Ragonnet, Alco, Precision, and Barco types of power reverse gears. From 1915 to 1924 my time was about equally divided between the operation of the manual and power reverse gears. Since 1924 I have had occasion to operate both manual and power reverse gears. I have never had a hand reverse lever become unlatched of its own accord and go to the corner, nor had one thrash back and forth over center. As a rule I handle a hand reverse lever with one hand and while sitting on the seat.

With power reverse gears I have had excessive creeping to the extent that they are closer than 25 percent cut-off. Creeping is likely to cause the engine to break away from the train and cause excessive fuel and water consumption.

When I was working as a locomotive engineer, it was my practice to inspect an engine before going out with it, and that was true whether the engine was equipped with a hand reverse or a power reverse. However, it is my opinion that a hand reverse is the easier to inspect as it has fewer parts, none of which are hidden, whereas with the power reverse there are many hidden parts. I consider the hand reverse as safer than the power reverse, as well as being the more efficient (T. 2853–2857).

H. S. RYDER on cross-examination, testified:

I have never see the lever of a manual reverse work out of the quadrant. It always stays where it is put. I have seen
785 quadrants with worn notches and dogs where the faces of the teeth were worn. While I have seen the lever rattle and shake

when the engine is in motion, this does not necessarily mean that there would be a tendency for it to come out of the quadrant. The dog just moves forward and backward in the notch, and the motion is caused by the reciprocating motion of the valve parts.

If I should be breaking in an engine just out of the shop, I might use two hands on the lever, because the parts would be fitted tightly. The same condition would result from dry valves as from an engine with such tightly fitted parts.

I have no opinion as to what would happen to the lever in the event the valve rings or piston valve broke. I have never had a valve strap break on a valve engine, nor pressure plates come loose or break. I have seen steam chests apart and know the function of both slide valves and piston valves. As to what would happen in case some of the valve rings should break and get caught in the ports, the valve might go over and break it off, or it might break some other part of the valve ring. I do not know what would happen if the valve rings broke and got caught in the ports and I would be throwing over the lever. I cannot say whether a broken counter-balance spring would cause the lever to handle harder (T. 2857–2864).

If the reach rod should break, I do not think that would have any effect on the lever. If the front part of the quadrant should get adrift, it might bind and it might not. If it did bind, the lever would be stationary and it could not be handled. There would be no effect upon me if the lever should get adrift while I was handling it. I do not think it would jerk me or cause any strain on me.

An inspection preliminary to taking an engine out on a trip is made by walking around it. Insofar as the reverse
786 mechanism is concerned I would look at the heel of the reverse lever, the main fulcrum, both ends of the reach rod, tumbling shaft arm, and rocker boxes. There is no link motion because all the engines are equipped with Baker valve gear, nearly all of which parts may be seen from the outside. During inspection I should see the counter-balance spring.

In the case of the manual reverse, the different parts of the valve motion are connected up directly to the reverse lever by means of the tumbling shaft and the reach rod, whereas with the power reverse those parts of the valve motion are connected to the piston of the air reverse and there is no direct connection to the operating lever in the cab. I do not think there is more danger in having these parts directly connected to the lever in the cab than in having them simply connected to the air reverse cylinder. I think the manual reverse is safer, because I have seen so many things go wrong with the power reverse—I have seen it creep back and forth and it was likely to injure anyone near it.

On Mountain type engines creeping would occur where the reverse lever was closer than 25 percent cut-off and the lever would work up on the center and cause the train to buck. I have never known or observed an engine pull apart from a train where the

cause of its pulling apart was the fact that it was equipped with a manual reverse lever. I have had experience with a train bucking where the engine was equipped with a power reverse, and the last time was in March although I cannot give the date. It happened south of Fallsburgh terminal and at that time I took the question up with the mechanical department, because the engineers were complaining that they were afraid to run the engines with power reverse, the difficulty being that there was excessive creeping,
787 and working with a short cut-off the lever would come up on the center and cause the train to buck. The gear was an Alco. We had an expert from the American Locomotive Company examine them and he eventually installed a friction device to hold the gear (T. 2864–2874) because the air would not. The friction device was at the forward end of the gear reach rod to make it rigid. These Alco gears were less than two years old, and at the present time the trouble has not yet been entirely overcome. I do not recall a case of anyone being injured with either power reverse or manual reverse.

In my territory there are about 40 locomotives equipped with power reverse and 125 with manual. We have not taken any of the power reverse gears off the locomotives and put manual gears back. We have had no new engines in our territory with manual reverse for the last five years, but the company has purchased engines equipped with power reverse (T. 2874–2876).

H. S. Ryder, on redirect examination, testified:

I have seen rough handling of a train with an engine equipped with hand reverse, but that was not due to the fact that it was equipped with that type of reverse (T. 2876–2877).

Roy Wilkins, a locomotive engineer employed by the St. Louis Southwestern, residing at Pine Bluff, Ark., age 49 years, testified:

I was first employed by the St. Louis Southwestern in 1901 as a wiper and call boy, and was promoted to fireman in 1902, and to engineer in 1907. I have had experience in all classes of freight, local, and passenger service, and have operated locomotives ranging from 70,000 pounds to 242,500 pounds on drivers. I have had experience with both hand and power reverse, having first
788 operated a power reverse in 1921. Since that time I have operated power reverse about 75 percent of the time, and hand reverse about 25 percent. My experience has been with the Ragonett and Alco types of gears. I have never been injured with a hand reverse. I have had experience with power reverse gears creeping.

On February 10, 1922, I was injured with a power reverse at Illmo, Mo. I got on the engine at the roundhouse. I do not know how long the engine had been standing, but the pump was shut off. The first thing I did was to turn the air pump on and then I started to oil the engine. I oiled from the back driver to the valve gear on the right side, and there had been no movement of the engine or

the valve gear. I put my hand between the reverse yoke and the valve frame to pull myself up on the step in order to oil the top of the reverse yoke, and immediately the air reverse went from the center to the forward corner and released me by going to the back corner where it stayed as long as I was there. Three fingers were cut off my left hand. That was with a Ragonett type of gear. There was no one on the engine at the time except the brakeman and he was sitting on the fireman's seat box. I think the lever was on center. There are several reasons for placing the lever on center where you have a Baker valve. One is that when oiling the engine, in forward motion, it is harder to get to the oil hole. The oil does not run on to the parts as it would if the lever is on center. The engine on which I was injured was no. 765.

Since my injury I have operated hand reverse and find no particular difficulty in so doing. The injury caused me to be off duty for six months, for which I was paid $3,000. I was in two hospitals,
one at Cape Girardeau and the other at Texarkana, Tex., the
789 latter being a company hospital. No charge was made for
my stay at the company hospital, but I paid a $97 hospital bill at the other one.

Based upon my experience, I believe this accident would not have happened with a hand gear. I am still running an engine. I do not know when the Alco gears were obtained by my company. The last new engines were received in 1930 and they were equipped with Ragonett gears.

When the power reverse is creeping, more fuel and water is used. Comparing hand reverse with power reverse, I think the one is as efficient as the other. I think the power reverse is safe as long as it is kept in good working condition (T. 2877–2884).

W. G. KNIGHT, residing at Derby, Me., employed by the Bangor and Aroostook Railroad Company as mechanical superintendent, testified:

I started as a fireman in 1901 with the Boston and Maine Railroad and continued in that capacity and as engineer, road foreman of engines, motive power inspector, traveling engineer, assistant general air brake inspector, and superintendent of locomotive performance. I left the Boston and Maine Railroad in 1923 and entered the employ of the Bangor and Aroostock Railroad as mechanical superintendent and have been with them ever since.

The Bangor and Aroostock Railroad Company own 61 freight locomotives, 13 passenger locomotives, and 7 switchers, a total of 81. Forty-six locomotives are equipped with power reverse, and 36 with manually operated reverse gears. Of the 46 power equipped locomotives, 35 are in freight service, 5 in passenger, and 6 are switchers. Every locomotive used on an important run, whether freight or passenger, or in constant switching, is equipped with power reverse gear.

790 Of the 36 locomotives equipped with manually operated reverse gear, 27 are in freight service, 8 are passenger engines, and 1 is a switcher. One freight locomotive, no. 93, is to be equipped with power reverse gear when in for classified repairs as it is the only one of its class not so equipped. Power reverse gear will also be applied to the switcher when it next receives classified repairs, and this will result in all switching locomotives being equipped with this device. One passenger locomotive, no. 243, is to have power reverse applied, as is also no. 242 if this engine is rebuilt and kept in service.

The 26 freight locomotives not equipped with power reverse gear and the one the company deems it undesirable so to equip are all of our "D–1" and "D–2" class. The Wythe symbol is 4–6–0, and none of these engines weigh over 112,000 pounds on drivers. These engines are equipped with Stephenson gear and balanced slide valves having counter-balance springs of uniform tension and adjusted so that a minimum of exertion on the part of the engineers will be required. Of the 8 passenger locomotives not equipped with power reverse gear, 1 locomotive, no. 206, is definitely out of service, which leaves 5 passenger engines which the company deems it undesirable to equip with power reverse gears. These 5 engines are small and light. The Wythe symbol is 4–4–0, and the weight on drivers is but from 58,800 to 64,600. The reverse gear equipment is the same as on the 26 freight locomotives just referred to.

(There was received in evidence a statement showing the 36 locomotives not equipped with power reverse gear, in which were specifically designated the ones to be so equipped when next in for classified repairs, the Wythe symbol of each locomotive, the
791 year built, the weight on drivers, tractive power, cost new, cost less accounting depreciation at January 1, 1931, the mileage run by each locomotive in 1929 and 1930, when each is due for classified repairs, and the cost to apply power reverse gears. This document was marked defendants' exhibit no. 37.)

The 26 locomotives of the "D–1" and "D–2" class all have the same cab arrangement. The engineer's seat is alongside the right-hand window, is stationary, and is so located as to give ample leg room. The reverse lever is to the left of the seat, the foot brace immediately by the right or the forward end of the quadrant. There is ample clearance at all points. Operation of the reverse lever does not require the engineer to leave his seat. When the engine is standing the lever is operated generally by the use of one hand, but sometimes both are necessary. While on the road it is not necessary to use more than one hand hooking up the engine. All moving parts of the entire apparatus are kept thoroughly lubricated to ensure ease of operation. All of these 26 locomotives are used on light runs and handle but few cars, and in general consume but small mileage during the year. Occasionally in the event of an emergency, but only for a day or two at a time, they are used in heavier service.

The mileage of these locomotives is steadily decreasing due to the recent purchase of heavier power equipped with all modern devices for convenience. I personally have ridden fully 50,000 miles on these hand-reverse freight engines and have never found the slightest difficulty in the operation of the hand reverse. It is seldom necessary for the engineer to use both hands and never has the engineer needed the help of the fireman or any other second person. We have no complaint as to the use of hand reverse gears on these 26 locomotives, nor have we any demand or any requests from
792 the engineers for the installation of power reverse on these locomotives. As a safety appliance there is absolutely no need for power reverse gears on these locomotives, whether it be in switching service or on the road, and the men do not have to leave their seats to operate them. At all times they can watch their signals and can watch grade crossings in exactly the same manner as where the engines are equipped with power reverse gears. There is absolutely no reason why these 26 locomotives should have power reverse gears applied. The manually operated gear is kept thoroughly lubricated and constantly in easy operation (T. 2885–2889).

The runs are short and the operations of the reverse lever are limited. The effort of the engineers is not at all exacting. To equip these 26 locomotives with power reverse would cost $11,050, or $425 each, the cost figures being based on the actual cost of equipping other locomotives. As to many of these locomotives it is doubtful if they will be retained in service when they are due for classified repairs. Present or future expense of equipping these locomotives with power reverse gears would be an unwarranted expenditure and would serve no useful purpose.

The 5 passenger locomotives which will remain in service and which are not to be equipped with power reverse are very light, perform but little mileage, and are very easy to operate. The cab arrangement of these locomotives is identical as to all 5, but it is somewhat different from the 25 freight locomotives previously discussed, particularly in that the quadrant is below the floor where the engineer rests his feet.

Clearances around the reverse levers of these passenger locomotives are at least equal to those on the 26 freight locomotives. I have ridden on these passenger engines more than 10,000 miles and can testify unqualifiedly as to the ease of operation. Only on rare
793 occasions does the engineer have to use both hands in operating the reverse lever and never does he have to call for assistance. The lever moves easily, generally is operated with one hand, and is kept thoroughly lubricated so that all parts are kept in the best of condition to ensure ease of operation. Never has there been a complaint of an engineer relative to the use of the hand reverse gear and never has there been a demand, request, or suggestion by any engineer that these engines should be equipped with power reverse gears. The expense of equipping these engines with power reverse gears would be $2,100, but it is wholly unnecessary

expense, would not in any way enhance the safety of operation or of the traveling public or of the engineers, and would be of no practical service in operation. The engineer does not have to leave his seat at any time in connection with the operation of the hand reverse lever and can observe signals constantly with the same effectiveness as in the use of power reverse gear.

Based upon my actual knowledge of the locomotives which the company does not propose to equip with power reverse gears and the history and use of the locomotives, based upon personal knowledge and the reports of the engineers, it is wholly unnecessary and undesirable from every standpoint that these locomotives should be equipped with power reverse gear, and that t oso equip them would be an unwarranted and unjustifiable expense.

We have put power reverse gears on 46 locomotives and are planning to install such gear on 3 or 4 more engines, because it gives convenience in handling of large locomotives and also because of the clearance which power reverse gear permits on the large locomotives.

794 We have considerable difficulty with power reverse gears, particularly due to creeping. We were especially bothered with creeping at first and had great difficulty in our efforts to overcome it, and it has by no means been wholly overcome.

We had one case where a power reverse gear engine stripped itself and have had broken air pipes in the power reverse gear which put the engine out of commission. In our climate we are also bothered by freezing of the reverse gear. We do not have these troubles with the manual reverse gear except that very infrequently the valve motion will freeze, but the gear itself does not freeze as does the power reverse. We constantly have to watch the power reverse gear—much more so than the hand reverse gear—in order to keep it in proper operation.

I have observed locomotives equipped with two separate valve gears instead of four valves—four valves and two valve gears. Immediately after the war I was connected with the Inter-Allied Commission with duties to take over the 500 locomotives for the American Army, that were set up in the terms of the armistice. In that group I think there were something like 100 four-cylinder balanced compound engines, having two sets of valve gears that were operated by one hand reverse gear. I observed those locomotives in operation. We had strict instructions from the commanding officers to see that these locomotives were good for at least six months service and that included a try-out test. In fact the tests given those locomotives were such that they would pass the inspection of the Interstate Commerce Commission inspectors if used on American railways. With respect to the ease or difficulty of operation in handling those locomotives, I found them a little bit slower, if anything, but fully half again as easy as the conventional Johnson bar.

795 I think they were equipped with a special type of hand gear

made by the locomotive builder. Those locomotives were built for the Baden State Railways and I think they were constructed in Bavaria (T. 2889–2894).

W. G. KNIGHT, on cross-examination, testified:

When I say that the 112,000-pound engines, equipped with Stephenson motion and slide valves, have their counterbalance springs given such attention that a minimum of exertion is required to handle the gear, I am assuming that the counterbalance spring is properly adjusted and that there are no other difficulties in the valve motion or the valve chambers. Valve gear adjustments are carefully taken care of, the springs are carefully lubricated to take full compression load without loss of free height, and the engines are worked out well after coming out of the shop. Everything is made suitable for ease of operation. Insofar as shopping extends, there is a rule that the reverse gear must be in a one hundred percent condition. However, if the counterbalance spring is not in proper adjustment, or the link motion binds at any point, or there is an obstruction in the steam chest, or there are dry valves, that would make a difference in the handling of the power reverse gear as well as the hand reverse—just as much care has to be exercised in the maintenance of the power reverse gear of the locomotive ahead of that as in the case of a hand reverse gear. The factors above mentioned cause the hand levers on both the power reverse and the manual reverse to operate harder, and whenever any of those contingencies happen I have found that it is sometimes necessary to use both hands and apply considerable strength to throw the engine over.

The purpose of the foot brace on the engines is to give a man better support in order to pull the lever back and thus
796 help him keep his balance when throwing the engine over. I have observed engineers brace their feet against the foot brace or some pipe or the boiler head to steady themselves when hooking up an engine on the road. The young engineer will often do it, but the experienced ones, with the particular engines to which I have referred, can generally hook up with one hand, that is when everything is all right. When hooking up on occasions when the valves are dry, the lever operates harder than normally and in such cases bracing of the feet would assist the engineer.

When an engine is running the tendency of the lever to pull away by reason of the weight of the valve motion is not constant. An experienced engineer running a locomotive in passenger service can always hook up with one hand if the reverse gear is all right, simply because the radius of the link changes to reverse the thrust on the reach rod, and therefore he can knock it back two or three notches at a time.

We have 35 engines with Baker valve gear, all of which are equipped with power reverse. When we buy new locomotives we

always specify power reverse as it is really a necessity on the modern engine.

If there were any complaints concerning the manual reverse I would know about them.

When I say that one of the reasons for installing power reverse on our locomotives is that it makes the locomotive more convenient to handle, I do not mean to convey the thought that it is easier to reverse one of the large locomotives with power reverse than with manual reverse. What I mean is that power reverse gives more room in the cab of the modern locomotive; such locomotives
797 with 100 percent boilers must necessarily have sufficient firebox area to bring the firebox out beyond any projected line of the tumbling shaft. I personally feel that a hand reverse gear could be perfected, for use even on the large locomotives, that would give practically the same ease of handling as the power reverse gears (T. 2894–2899).

I have always been able to reverse the engine and to handle properly the reversing mechanism where the power reverse was maintained in proper shape. Any disturbance in the valve chamber, such as broken rings or dry valves, is not felt on the hand throttle of the power reverse, because the vibration from the valve gear would not pass back through the column of air to the handle of the reversing gear, but under such circumstances there would be set up such a stress in the valve gear that no doubt it would throw the engine in reverse position. And we have had that happen. But even with that experience I have found that the hand operating lever in the cab remains stationary on the power reverse gear, so there is no danger of the lever in the cab striking the engineer even if there be some disturbance in the valve chambers or the valve motion. However, there are other dangers that might come in. An engine traveling 60 or 70 miles an hour and put into back gear would not be determined as quickly as it would with the hand operated lever and in such case it would strip the engine and no doubt cut the cab right out from under. We had that experience once and although no one was hurt, everything broke ahead. If the eccentric rod had been clipped off that would have clipped the cab right out from under. Fortunately the union link broke instead. We have had engines strip themselves where they were equipped with the manual gear, as where there happened to be a broken eccentric, which happens once in a while. However, there is no danger of that
798 eccentric coming up and striking the reach rod as the location is quite removed from the eccentric—in fact, it would have to come up around the side of the boiler. What I have said applies with respect to the Stephenson gear; there would be a difference in the case of a broken eccentric on a Walscheart gear. With a broken eccentric on the last-mentioned gear, the thrust on the reach rod and the reverse lever of the old style would be lessened because of the decrease in the travel of the valves. In other words, the broken eccentric rod on the Walscheart gear would leave the link free to

travel back and forth, and it would only be influenced by the lap and lead lever. A broken tumbling shaft on the reach rod in the case of a manual reverse gear would throw some stress on the lever in the cab, but on the power reverse engine that stress would be taken up by the air cylinder (T. 2899–2902).

J. H. CURTIS, residing at Bangor, Me., employed as division superintendent for the southern division of the Bangor and Aroostook Railroad, testified:

I started railroading in 1900 as a baggagemaster and switchman, and worked up through the positions of station agent, train dispatcher, and superintendent of car service. In 1917 and 1918 I was with the American Railway Association in Washington in the car-service section. In 1919 I returned to the Bangor and Aroostook as trainmaster and served in that capacity until 1923 when I was made division superintendent of the northern division. About a month ago I transferred to Bangor in charge of the southern division.

I am perfectly familiar with all locomotives listed in exhibit no. 37, due to my riding freight trains and locomotives and
799 watching their operation. I have done this since 1919. While I was trainmaster I was on the line all of the time, and on freight trains most of the time. I have observed the operation of locomotives by engineers, and with respect to the operation of the manually operated reverse gear, I have never seen them have any trouble. Operating a manually equipped engine in switching service, an engineer usually takes a position sitting on the seatbox with his back to the window, facing the reverse lever, so he can see in both directions, get signals and operate the reverse lever. On these locomotives there are windows both at the front and at the rear of the cab on the engineer's side. In order to see signals the engineer usually leans back, looking out of the window, although it is possible for him to look through those windows in the back and front of the cab. Engineers, in running over the road in forward motion, usually sit on the seatbox in the direction in which they are going, leaning out of the window. This seatbox is stationary on the deck.

The engineers as a rule use only one hand in operating the engines, that is, when they get a signal to go ahead they start the train and keep hooking the engine up with one hand as they increase speed. I have not observed any occasions when it was necessary for the engineers to call for assistance to handle the reverse lever, and they never seem to exert themselves in operating the hand reverse. They are able to see signals along the roadway and to keep a look-out at the grade crossings while operating with the manual reverse. In fact the view is a good deal better on engines equipped with manual reverse than on engines equipped with power reverse, the reason being that the boiler is shorter and there is a better view ahead.

Off and on I have operated the hand reverses occasionally. I have never been injured nor have I observed any injury
800 taking place in connection with such hand reverse.

In my experience I have never observed any occasion where a hand reverse lever became unlatched in the quadrant by itself and went down to the corner, except when done by the engineer. I have never had an occasion where the lever, after it was unlatched, pulled away from me.

With respect to the engines mentioned in exhibit no. 37, at present they are run on branch-line trains where there is light tonnage to handle, and as relief engines. That is the only use made of them. They will continue to be used on branch lines where the work is light, in both passenger and freight service. I have at no time, either while trainmaster or division superintendent on the northern or the southern division, had complaints from enginemen with respect to the condition in which the manual reverse gears and their parts are kept; they have all told me that they were well kept up and that they have had no trouble with them. That has also been my observation (T. 2902–2908).

J. H. CURTIS, on cross-examination, testified:

I have never seen an engineer have any trouble with a manual reverse lever, and by that I mean I have never seen a lever unlatch and fly to a corner or a condition of that character. I have never seen a lever work out of the quadrant and go down a notch or two; they always stay perfectly stationary in the notch where they are put. I have seen a small vibration of the lever, back and forth in the notch, but I could not say what was the cause of it as I have never run an engine as an engineer. I have not handled the manual reverse bar in the last year. In fact, I have not handled one since

I was trainmaster, seven or eight years ago. At that time,
801 just for the fun of it, I would occasionally take the engine and run it a little way. I would do that, possibly, once a month. On such occasions I would take the engine when it was standing still and start it, but you, of course, understand that that was always under the supervision of the locomotive engineer. I could always handle the lever with one hand. The highest speed at which I ever handled a lever was at 15 or 18 miles an hour, at which point I would hook it up to the position desired.

It is the practice of all engineers on our line to lean out of the cab window to get signals in either direction. So far as the air reverse is concerned, on the locomotives that we have the boilers are a good deal longer than on the ones that are manually operated, and that is the reason why the view through the front window of the cab would be cut off. The power reverse control lever in the cab is right alongside the engineer. Although, as a rule, on our locomotives the engineer who has his head out of the window would have

to reach in to get hold of the lever on the power reverse, he could however by reaching get hold of the lever without taking his head inside the window, and I have seen them do it. However, most of the time, in hooking up fine, they have to look at the quadrant because the teeth of it are so fine that the men must locate them and at the same time bring their reverse lever up to the position where it is kept for running. When they first start out of the yard and until they want to bring the engine up to a fine point they can look out. For the period of time that the engineer is putting the reverse lever into the position in which he keeps it for running, the fact that it is equipped with power reverse interferes with his view
802 ahead. The operation of the manually operated lever is not fatiguing work, and in the 15 years I have been on the road I have never observed men brace themselves by use of the foot brace and take both hands to throw the lever from (T. 2908–2912) back to forward motion. I have never seen any of our engineers use the foot brace, and while I have observed them taking both hands to throw the lever it was not necessary for them to do so. The reason I say that is because I have seen them do the same thing with one hand under the same conditions. Speaking from personal knowledge and from what the men have told me, they do not have to exert themselves in throwing over the lever. I have never seen an engine where the engineer was having difficulty with dry valves, nor seen one where the counterbalance spring was out of adjustment. I do not know what their experience would be in handling the lever if something was wrong with the manual reverse gear.

On my road there is an organization of engineers and firemen but they are not affiliated with the Brotherhood of Locomotive Engineers or the Brotherhood of Locomotive Firemen and Enginemen.

If an engineer reported any trouble with a manual reverse gear, it might come to my attention and it might go to the mechanical superintendent. As I do not see the work reports made by the engineers I could not tell whether such reports have ever been requests for repairs on a manual reverse. The reason that the engineers told me that the hand reverse levers were all right and kept in good shape was because I asked them about them. That was about three weeks ago, and then I have talked with them off and on. I told them why I wanted to know about it.

I think it fair to say that an engineer does not have to exert himself to throw a manual reverse lever, that is in so far as the locomotives of the Bangor and Aroostook are concerned (T. 2912–2917).

803 When I have operated engines it has been for distances of only 5 or 10 miles at a time. The engineer would be right beside me and he would tell me when to hook her up. I would say that I have done this between 35 and 50 times. On those occasions

the engineer handled the air. I would be sitting on the seat, and he would be standing right at the corner of the seat, behind me. This seat comes out about 8 inches from the side of the cab and is about 15 inches long.

I would say that the hand operated lever would extend about 3 or 3½ feet above the deck of the locomotive. I do not know the length of the arc through which the top of the lever would pass from full forward to full backward motion, and I do not know the distance between the side of the cab and the lever.

An engineer can look out of the side cab window and reverse the engine until he gets it very near to center. Then he looks inside at the quadrant in order to avoid going into back gear (T. 2917–2923).

H. E. TEWKSBURY, residing at Oakfield, Maine, employed by the Bangor and Aroostook Railroad as traveling engineer and air brake inspector, testified:

I started railroading in 1906 with the Canadian Pacific and went to work with the Bangor and Aroostook in 1907. I remained with that road until the fall of 1909 as a fireman. I did not take up railroading again until 1916, when I was again employed as fireman. In February 1918 I was promoted to engineer, and in 1925 to traveling engineer, which position I have since held.

My duties as traveling engineer are to ride the locomotives and to supervise the work of the enginemen, and to look after the re-
804 pairs of the locomotives, fuel consumption, etc. I ride the locomotives all of the time except when I am in the air brake car giving instruction. It usually takes me three months to go over the road with the air brake car, and the rest of the time I devote to riding the locomotives. While so riding the men discuss freely with me the condition of the various parts, as well as the maintenance and operation thereof.

During the period of my service as a fireman on the Bangor and Aroostook, I observed how the engineers handled the manual reverse levers; and since being employed as traveling engineer I have also noticed the operation of the manual reverse lever. While I was employed as an engineer I had experience in the operation of manual reverse gears, and since being employed as traveling engineer I have from time to time had occasion to operate the hand lever on engines equipped with manual reverse gears. When I was serving as an engineer we had a few engines equipped with power reverse gears. I ran some of them at that time and also since becoming traveling engineer. As traveling engineer I have supervision over all locomotives on the line, and am thoroughly familiar with them, both those equipped with hand lever and those equipped with power reverse.

Where the engine is equipped with hand reverse, the enginer sits on the seatbox facing the direction in which the engine is traveling.

When he desires to reverse the engine, he sometimes takes two hands and sometimes one hand to throw the lever from forward to back gear. Most of our reverse gears are so put up that the reverse lever, if it is in the forward corner and no steam in the cylinders, when taken out of the latch will move of its own accord back to the center notch or near the center notch. That is accomplished by the counter-balance spring on the tumbling shaft. I do not recall ever having exerted myself in the operation of a hand reverse
805 lever and I have never observed any other engineers exerting themselves to operate such a lever (T. 2923–2927).

I have seen times when I was more tired after operating a power reverse gear engine than I was after operating one with a hand reverse, for the reason that in heavy switching service, with the power reverse engine, you are sitting in one position—that is, you are more or less cramped. With the hand reverse engine you can move around, which results in your becoming less fatigued. I do not recall any cases in recent years where it has been necessary for the engineer to call for assistance to operate the reverse lever. I have never received any complaints from engineers about engines being hard to operate.

Within the last few months I have made special trips, paying particular attention to the matter of hand operated reverse gears, in connection with this special inquiry. On one of these special trips with engine no. 56, allocated to a run having more switching than any other, I took particular notice to see how the engine handled. The engineer used one hand to reverse the engine when standing still with no steam in the cylinders, and while on the road he would sometimes use two hands to hook her up and sometimes only one. The hooking-up did not appear to interfere in any way with his keeping a lookout-ahead. Referring to the engines listed in exhibit no. 37, they all have ample clearance for an engineer sitting in his usual position on the cab seat. There are no parts of the engineer's body or legs in a position where they would be struck by the lever. Furthermore, there are no appliances which the engineer has to reach for or operate, or any duties to be performed by him, which require him to place himself in a position where he may be struck by the hand reverse lever.

806 We have had trouble with power reverse gears creeping ever since they were installed, and by that I mean, if it is desired to hook the engine up one notch off center, the gear would not hold there. It would either allow the engine to creep down two or three nortches or sometimes allow it to come up back by (T. 2927–2932) the center. With engines standing, I have known the power reverse gear, such as the Ragonett, to creep three or four notches, and if anyone was oiling around the gear and was not careful he might get caught therein.

I know of an engine starting out of the roundhouse at Northern Maine Junction when the crosshead on the power reverse gear was on center position but the reverse lever had been moved after the air had gotten out of the reservoirs on the engine. The air pump was started by the hostler. He got down off the engine and after the air pressure had been pumped up the power reverse flopped over and the engine started out of the roundhouse. There was no one on the engine. Saying that the gear flopped over can be explained by pointing out that with the old Ragonett gear the reverse lever could be moved without moving the reverse gear itself, that is, without moving the valve motion. The engine got steam to move herself either because the throttle was leaking or because there was steam in the valve chamber. She was under steam.

I have looked out of the cab window at times when locomotives were creeping and I would say that I have observed the crosshead in the air reverse mechanism moving over two inches. This creeping which I refer to applies to both types of gear in use on our road, namely, the old Ragonett and the new type Alco "G." With
807 respect to the engine which I saw move out of the roundhouse, it was stopped by the hostler jumping on it and applying the air brakes. On occasions in connection with creeping while the train was moving over the road, I have observed the valve motion creep to such an extent that the steam was working in back motion while the train was moving forward. I have seen that about three or four times in the past six years. From my experience I consider the hand-operated lever is fully as safe as, if not safer than, the power-operated gear (T. 2932–2937).

H. E. Tewksbury, on cross-examination, testified:

It was my duty as a fireman to stay on my seat and observe signals and watch for crossings when not actually firing the locomotive, and I therefore only occasionally got a glimpse of engineers handling reverse levers.

Under normal conditions fifty miles per hour is the highest speed at which I have handled the manual reverse lever. At that speed I face in the direction in which the engine is going, usually taking hold of the reverse lever with both hands in order to hook the lever up another notch and get a shorter cut-off, and, while it is not necessary, bracing my feet in order to overcome the pull of the lever against me. While it is not necessary to use two hands with our engines, it is done, more to steady the reverse lever against the link block stoppage, that is, if I wanted to hook up only one notch out of center, I would use two hands to steady the lever so that it would not get more than one notch.

The procedure to be followed in hooking up an engine running at 20 miles per hour depends upon the position of the reverse lever at the time you started to hook up; if the engine was down to

808 half stroke one would ordinarily take one hand and pull it up a few notches. There is not very much difference between the way the lever handles at 20 miles per hour and the way it handles at 50 miles per hour, neither is there any more danger in handling the lever at one of those speeds than at the other.

The travel of the valves in the steam chest has an effect upon the handling of the lever in that the shock of the cut-off and the pull on the lever is transmitted by it.

The pulsations of the valves can be felt when the engine is working, and at 50 miles per hour, with the rapid pulsations, the pull on the lever is greater than at 20 miles per hour. However, the pulsations at 50 miles per hour become so fine that they do not seem to effect the reverse lever as much as at a lower speed with a longer cut-off.

In handling the lever at 50 miles an hour, the engineers, I have noticed, sit in their usual position on the seatbox and take the reverse lever in two hands and hook her up one notch. Of course at this speed the engine is hooked up quite close. While I have never seen a man stand up to reverse an engine, it is my opinion that it is safe to do so. When reversing an engine from one corner to another while sitting on the seatbox, you do not brace your feet, and there is no tendency on the part of the lever to throw you off balance when the engine is standing still and you are reversing it.

The reason I have been more tired at the end of a day's operation of the power reverse than at the end of a day's work with a hand reverse is because I have to sit in the same position without any change, leaning back across the window sill, and this tires my back. Although this position is to a certain extent the same as with the manual reverse, it is to be understood that when reversing with the manual lever an engineer leans forward to take care of the

809 reverse lever, and thus at times gets out of the position of leaning against the window sill. In other words, with the power reverse you do not lean forward as often or change your position as often as with the hand reverse. While you do not remain perfectly stationary in operating a power reverse, you do not have the opportunity to change your position around as much as you do with the manual reverse. In switching service I reverse an engine possibly 50 times an hour, and I can reverse an engine with a manual reverse quicker than I can one with the Alco power gear. It takes me possibly three or four seconds to reverse with the Alco. I have used the manual and the power reverse engines on (T. 2937–2943) the same jobs and have thrown the manual reverse over on the average of once a minute and never noticed any stiffness or soreness in my muscles as a result thereof.

I do not consider anything unsafe about a manually operated lever although I would not advise an engineer to get his body into any position in which the travel of the lever might come through. I

have often seen men pass between the reverse lever and the boiler head with the engine running and the lever hooked up, and I do not know why that is not safe. An engineer never has to get behind the lever to push it with his body.

I have seen engineers with their feet on the forward end of the quadrant, and as a matter of relaxation engineers over a day's period of work have their feet in different positions. In allowing their legs to move around they sometimes do put them in a place on the quadrant or near the quadrant where the lever might strike them if it became unlatched and traveled the full length of the quadrant. However, if the lever became unlatched with your feet on the quadrant at the forward end and the engine was going in forward motion, I do not think they would be in an unsafe
810 place, as the reverse lever can only get down so far and there is ample clearance between where the reverse lever stops in the head gear and the end of the boiler so that a man would not get his feet jammed. If his foot did come in contact with the lever while it was going to the corner, it would simply push his foot off the quadrant.

The largest manually operated engine with which I have had experience is a 112,000-pound one, and that in yard service.

No man under my supervision has ever asked me to do anything about a hand operated lever as they look out for them themselves. If the reverse lever moves harder than the engineer thinks it should, it is booked on the work report and is fixed. I do not recall any cases within the last five years where work reports were made out relative to manual levers. They may have been made out, but I did not see them. I follow engines when work is reported to be done on them for the purpose of seeing that the repairs are made, and I examine the work reports, but I do not remember having found one relative to manual reverse.

During the past five years I have observed notches on the quadrants having become worn to a certain extent and have also noticed forward faces of the dogs slightly worn. I consider such cases as defects and have repairs made. When I stated that I never had any trouble with manual reverse, I meant insofar as the ease of operation of the engines is concerned. Getting manual reverse gears to operate easily is the most common trouble we have with them. Some of the old gears worked much harder than the ones we now have, because they were not maintained in as good condition as at present. In those days lubrication was cut down to the lowest point, but now we have a free hand with respect to oil and the engines are perfectly lubricated in every respect. At the present time there
811 are no hard operating conditions that I know of. In the old days the engines were not shopped as often as now, and the small defects if not repaired, together with the lubrication, had a lot to do with the ease of operation of the valve gears, the fuel

economy, etc. Lack of lubrication causes the use (T. 2943–2949) of more coal and water. If an engine is not properly lubricated the valves will work harder and that puts more pull on the reverse lever when the engine is running. You always get pulsations on the reverse lever even when the gear is in good condition, that is, not binding. When the valves are dry there is also a harder pull than when they are not. I never tried to hook up an engine or drop it down with one hand when the valves were dry. It was from force of habit that I would use two hands in handling the levers on the old type engines.

Several times I have observed power reverse equipped locomotives move without anyone in the cab handling the lever, and we had one man injured that way, but I did not see the accident.

On the occasion referred to, when the engine walked away in the roundhouse, the lever was in a position back of center, and under circumstances like that I would expect an engine equipped with power reverse to move if steam got into the cylinders. Upon that occasion no one was injured and no damage was done. I can not say how steam got into the cylinders in that case. It might have been caused by a leaky throttle, and, furthermore, if the hydrostatic lubricator had been turned on that would have caused steam to get into the valve chambers, providing the valves were on center. If the engine had been equipped with a hand reverse, the steam would have built up just the same, but the engine would not have
812 moved. Referring to this accident, the reverse lever should have been on center, because the crosshead of the power reverse was in the center position. In order for it to have gotten into back position, someone must have moved it after the air was drained off the main reservoir. In the case of a manually operated lever, if the person had moved the hand lever back, it would have been noticeable and he would have restored it to the center position. On a power reverse the lever is behind the boiler, and a hostler would not notice it as quickly as he would a hand operated lever. In order for a hostler to determine where the engine is so as to bring it on center or in the corner, he looks at the reverse lever if he is in the cab (T. 2949–2954).

I have experienced an engine reversing itself with power reverse three or four times, but no one was hurt nor was any damage done to the locomotive or equipment. Lack of lubrication on the valves of the manual reverse gears would cause greater fuel consumption, as this lack of lubrication causes the reverse gear to move harder and therefore engines could not be hooked up as close. Furthermore an engine could not be run with as short a cut-off and heavy throttle with dry valves as it could if they were in good order. I found out about the excessive use of coal when I was firing, and that engineers did not hook the engine up with a close cut-off. My experience with

dry valves was had before I became an engineer. I myself never let an engine get dry valves. The dry valve occurrences which I referred to were on hand reverse engines.

With power reverse it is impossible to tell whether the engine is getting oil or not; there is no way to tell except by the dry
813 condition of the cylinders and valves; you cannot feel the pull of the dry valves as well on the power reverse as on the manual reverse. If you know that valves are well lubricated, you know the engine is easier on fuel and water. On those runs in the early days there were some where the lack of lubrication on the valves was due to the lubricator going dry. A well-lubricated engine, burning five tons of coal, would, in my opinion, use an additional half ton during the day's work if the valves got dry. That difference is partly because of the increased power it takes to pull the valve and since the valves work hard the engineer will not hook the engine up to as short a cut-off. He will work a lighter throttle and a longer cut-off. I would say the reason the (T. 2954–2959) engineer would not hook her up was because the engine would not work properly hooked up close; if the valves were dry and the engine laboring hard, the engineer would not get as long a valve travel, hooked up close—the valve would sort of stick. An engine will use more steam with the long cut-off, as the valve will have to move farther on every stroke and the dry valve would consume more energy in moving the longer distance. However, operating under reduced steam pressure, the throttle is not open as far as usual, and thus if the engineer had the engine hooked up short with the full throttle, the engine would labor if the valves were dry. Running at high speed with dry valves, I cannot say whether there would be such a pull on the lever as to make it dangerous to handle. I have had no experience on the Bangor and Aroostook where the valves have been so dry that it made the coal consumption excessive; however, it is on the Bangor and Aroostook that I have observed power reverse creeping, resulting in increased fuel consumption, but I have never fired one of those engines. When the power
814 begins to creep on one of our engines the fuel consumption begins to go up, and knowledge of that fact is based upon the ton-miles per trip, a record of which is kept. All of the engines have an allowance—both ton-miles and the coal consumption per trip. I find in most cases where the creeping amounts to anything that it is reported by the engineer and sometimes it can be corrected. When the engine is operating on the road it is hard to correct. Such creeping would have to be corrected after the engine goes to the roundhouse. The creeping can be so corrected that it will stop. I have no record of the same locomotive on two trips with approximately the same number of ton-miles, where it crept on one trip and did not on the other. It is from the weekly coal reports that I ascertained that there is an increased fuel consump-

tion. When the coal consumption begins to go up, we attribute the increased consumption to the power reverse gear creeping. These reports do not show that the power reverse was creeping, but if the valve gear is creeping we attribute the increased consumption to that and we arrive at the fact that there is creeping by personal observation (T. 2959–2964).

H. E. TEWKSBURY, on redirect examination, testified:

I weigh about 148 pounds and am 46 years old. The largest locomotive I have operated equipped with the hand lever type of reversing gear weighed about 140,000 pounds on drivers. I have never experienced any danger in hooking up the hand lever type of reverse on an engine at any speed or with any condition of valves. With respect to my statement that the creeping of the power reverse can be corrected, I will say that sometimes it will stay corrected for two or three weeks and perhaps longer; at other times after the engine has made 5 or 10 miles it will start creeping again. That does not apply to any one type of gear which we are using (T 2964–2965).

815 G. H. TRUMAN, a retired railroad employee, residing at St. Paul, Minn., age 73 years, testified:

I was retired May 28, 1928. I was first employed by the Lake Shore & Michigan Southern, in 1873, as a fireman, and was promoted to engineer in May 1880. I left that road in December 1880 to go with the Minneapolis & St. Louis as an engineer and remained with that road until December 1882. In January 1883 I went to work for the Northern Pacific and remained with that road until 1928. I became road foreman in 1906 and continued in that position until 1913, when I went back to running engines.

From the time I was promoted to engineer in 1880 my work as an engineer was continuous except for the periods I changed from one road to another and the period I was road foreman.

I have never had any experience running engines equipped with power reverse gears. One time, however, I was called to take out a power reverse equipped engine, no. 2227, and that was May 30, 1921. The engine had just come in on a train and was standing in front of the depot at Jamestown, N.D. There was a hot box on the engine, and while it was being packed I had to oil the engine. I could not move the engine into the position I wanted for oiling. I oiled all the right side and started to oil the wedges of the left front driving box, having my arm under the radius rod. The reverse lever and the links moved ahead, and the reverse lever and the radius rod were lowered, catching my right arm and breaking it. I did not take the engine out on the run. I was off duty for two years and the company paid me $8,750. I received hospital treatment without cost. At the present time I do not have the full

use of my arm—the wrist is sort of stiff. Returning to work
816 after the accident, I operated locomotives until I was retired, but they were all equipped with manual reverse.

I have never been injured with the hand reverse or seen anyone injured thereby.

My seniority rights would have permitted me to operate engines equipped with power reverse, even after my injury.

I do not know whether anyone moved the reverse lever and do not know what happened in the cab at the time I was injured (T. 2965–2971).